Beyond Walking Distance
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Beyond Walking Distance
The gains from speed in Australian urban travel

by Ian Manning
formerly Research Fellow
Urban Research Unit
Australian National University

Urban Research Unit
Australian National University

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The shortcomings and foolish judgements are my own.

Ian Manning
Melbourne, March 1983.

A companion volume to this, chronicling the technological and administrative history of roads and public transport in Australian cities, has been published by Pylon Press and the Australian Electric Traction Association (Sydney) under the title The Open Street.
Introduction

In the past, walking was virtually the only way of getting about in cities. The verb 'to walk' was very nearly synonymous with 'to travel'. This was as true when the cities of Australia were founded as it had been in the cities of Asia, Europe and America for centuries past, ever since the beginning of the urban way of life. A minority of aristocrats or other wealthy people could afford their own horse and carriage, but by and large people walked.

In Australia the first suburban railways were opened in the 1850s, and experimental horse bus and horse tram services were running in most cities by the 1870s (Manning 1983:Ch 1). However, the dramatic changes came in the century following. In these hundred years, in Australia as in other wealthy countries, the normal means of getting about in cities changed twice, first from walking to trams, trains and buses, and then from public transport to the motor car. Some aspects of the change have been chronicled in detail — there are, for example, excellent accounts of technological developments in transport, both overseas and in Australia — while others have proved too subtle to describe. Changes in transport have been so intimately bound up with the process of becoming richer, with economic growth and development, that it is difficult to disentangle one from the other; to separate the effects of improved technology and the increasing use of energy in moving people from their general effects in increasing wealth.

The difficulty in disentangling the effects of improved transport from the other aspects of economic development would be of no account if we did not wish to use past experience as a guide to the future. However it is no longer automatically true that increasing wealth and income will be accompanied by ever faster and more comfortable transport, and to prepare for this future in which there may be economic growth but will not be faster transport we need to know the effects of fast transport to date. Can urban growth continue in the pattern of the 1960s and 1970s? More important, should it so continue? There may be changes in town planning practice which would enable some of the costs of fast transport to be avoided, or minimised; and other changes which might take greater advantage
INTRODUCTION

of its merits than is possible at present.

A second reason for wanting to evaluate the effects of fast transport has been the need to impose control on government investments in transport infrastructure, and on subsidies to transport operators. Attempts have been made to do this within the framework of cost-benefit analysis, but the argument of this book is that no precise calculations can be made of either costs or benefits. We are rather at the stage where a balance sheet can be drawn up, and most of the items which should go on either side can be identified, but a cash figure can be put on only some of them. Such partial cash estimates should not be allowed to decide the case.

There are two major problems in evaluating the benefits and costs of faster transport. The first is that it takes a long time for cities to adjust to the introduction of a new means of transport. People only gradually come to make use of it, and as they do consequent adjustments are made to locational patterns with the urban area. These adjustments take decades to complete, but may completely change the pattern of benefits from that initially expected. The benefits from particular transport investments - a freeway, a new rail line - as well as continuing subsidies and taxes, can only be finally assessed after allowance for their effect on locational patterns, yet these changes take a long time to appear and may not be easy to disentangle from changes due to other transport investments, or to non-transport causes. These long time lags and uncertainties of identification make the benefits of spending on transport very hard to evaluate.

The second major problem is a consequence of the slow mutual adjustment of urban locational patterns and transport facilities. It is that the terms of choice on which many urban transport decisions are based do not properly express the final results of the choice. A simple example is that when people choose to travel by car they wish to take advantage of greater speed, but when many individuals make the same decision to travel faster on the same road at the same time the result may be traffic congestion to the point where nobody travels speedily. Similarly when people individually switch to faster transport they are not seeking to change the locational pattern of facilities within the urban area except perhaps in a very small way, as when the transport switch is made jointly with a move to a new house in the outer suburbs. However when many people make the switch, and locational patterns change as a result, the changes were not consciously chosen by anybody, but came about through the accretion of small, partial choices. There is no reason to regard the results of such a process as
being for the best of all concerned — hence the need to stand back and assess the overall results of the adoption of faster transport.

In this book the process of assessment is carried out in five chapters, which may be summarised as follows:

Chapter 1 provides a brief history of the means of transport in use in Australian cities over the past century. When public transport was first mechanised, and similarly after the introduction of the motor car, there was a sudden increase in the speed available for urban travel. This faster transport was available only at high cost — fares in the case of public transport, and car purchase and running costs in the case of motoring. However, with time the costs came down, and, more important, people's incomes rose so that they could afford faster transport. They therefore changed from walking to using trains, trams and buses a great deal, and then a generation later deserted public transport in favour of motoring. Rising incomes and improved technology had enabled people to travel faster.

It might be thought that the benefit of travelling faster is that the necessary daily round of journeys can be performed more quickly, thus releasing time for other activities. However, in actual practice people have used faster transport to travel further in the same time. In Chapter 2 data is presented to prove this point, and to provide estimates of changes over the past century in the length and duration of typical journeys.

Though people have taken advantage of faster, more costly transport to travel further, they have not done this to cover distance for its own sake. The benefits they have expected in travelling further have rather been an increased choice of destinations — of workplaces, of shops, of other urban facilities — and also an increased choice of places to live. Faster transport has enabled people to shift to houses at or beyond the urban fringe, so that new, spacious suburbs can be built. Increased travel distances also mean that urban facilities can be concentrated, as when the decision is made to have four-stream high schools to which students come by bus, rather than one-stream schools within walking distance of the students' homes. Similarly neighbourhood shopping centres to which people come on foot may be replaced by supermarkets set in wide car parks. In Chapter 3 the final list of benefits is summarised as follows: when faster transport is adopted, the physical size of cities can increase, so that (1) they can accommodate population growth and simultaneously achieve (2) reductions in overall density. At the same time (3) urban
facilities can be concentrated, while simultaneously (4) the range of facilities to which people have access can be widened.

A subsidiary theme of Chapter 3 is the fact that public transport tends to centralise facilities, while motoring has allowed them to disperse. The dispersion of facilities has heightened the trade-off between journey distance and range of choice, but has loosened the constraints which transport used to place on urban size and density. It has also been to the considerable disadvantage of those who do not have access to motor transport.

Once allowance is made for the changes in locational patterns consequent upon the adoption of faster transport, it can be seen that the ultimate benefits of speed have diverged from those which people hoped to gain when they made their individual choices. Time savings have been swallowed in increases in distance covered. The widened range of geographic choice has been modified by increases in the size of cities and by the simultaneous concentration and dispersion of facilities. Similarly the costs of faster transport have not always been adequately reflected in the cash payments people made when they switched to faster transport. Chapter 4 assesses some of these extra costs, including cash costs borne out of the public purse (subsidies, road-making costs), environmental costs, the costs of collisions, the possibility that fuel has been underpriced, and the costs borne by those who are not able to avail themselves of the majority means of transport. A few of these costs could be brought home to those who occasion them by changes in the pricing of transport, but most require changes in regulations and in the pattern of subsidies.

In the final chapter a case is made that no further increases in the speed of urban travel are likely. The century of adjustment to faster transport is now over, and public policy on urban transport should now turn from aiding this adjustment to conserving the gains, minimising the costs, and assisting those who for any reason lose the use of the fast transport to which they have become accustomed. Such losses will occur to individuals even if the supply of fuel is maintained, and may become general should that supply be disrupted. The policies advocated in Chapter 5 are not new; they have been current in the town planning literature for decades, but have so far generally been defeated by vested interests committed to incremental urban growth.

Though the argument of this book is that fast transport imposes general public costs in addition to those paid by its individual users, and at the same time the benefits have been different from those which the users thought they would
receive, it does not deny that there have been net benefits, and that for many families - probably the great majority - these benefits have been considerable. The suburban house and garden is for nearly all people a manifest improvement on high-rise or other high-density living. The question, therefore, is how to retain this and other benefits while minimising the costs of speed, both now and into the uncertain future.
Speed and cost

The main achievement in Australian urban transport over the past century has been to replace low speed, low cost transport with high speed, high cost transport. This achievement was made possible by the growth in incomes, which meant that people could afford more costly transport, and were able to take advantage of the application of mechanical power to urban travel as it evolved through a series of technological innovations, beginning with the suburban railways of the mid-nineteenth century, continuing with the street tramways of the later nineteenth century and ending with the introduction of the private motor car early in the twentieth. In each case the gain in speed was immediate, but was purchased at first at a high cash cost. Only gradually did increasing efficiency and popularity bring down the cost of the new means of transport, and this along with the rise in incomes brought it within reach of the majority of the population. This chapter describes these increases in speed and cost.

Walking

In the early nineteenth century the main means of transport in Australian cities was walking — eminently healthy and cheap but tiring and slow. Even if a pedestrian breaks into a trot he is only going a tenth as fast as a present-day motorist driving at the urban speed limit. However before cars were available nobody knew that such speeds were possible on the road, and were therefore content with the average human walking speed of around 5 kilometres an hour. As mechanised transport was introduced people became accustomed to travelling at speeds double walking, then triple and more, but walking speed remained constant, as did its cash cost. Walking is still virtually free.

Public transport speeds

Public transport operates by gathering people together in a train, tram or bus and carrying them at speed to some point near their final destination, where they are set down. A considerable proportion of the total time devoted to any public
transport trip is therefore spent on foot getting to and from the stations and stops; and a further portion is usually spent waiting for the train, tram or bus. Typically half or more of the total duration of a public transport trip is devoted to walking and waiting (Table 1.1). This means that even if the line-haul portion of public transport trips is substantially accelerated, the overall gains in speed will not be great unless walk/wait times are also reduced. Unfortunately the way to increase line-haul speed is to reduce the frequency of stops, but this increases walk/wait times. Public transport can therefore be divided into two kinds of service, according to the answer given to this dilemma. It can provide either limited-stop services, with high line-haul speeds but long walk/wait times, or frequent-stop services with shorter walk/wait times. Limited stop services are only justified where traffic is heavy, so they are usually confined to a small number of routes. In Australia limited stop services have been provided by the suburban railways from the 1850s onwards, and from the 1970s limited stop bus services were introduced, many of them on freeways. However most tram and bus services have been and still are frequent-stop.

Though walk/wait times make a major contribution to the duration of public transport trips, we do not know whether they have increased or fallen over time. The only way to find out about walk/wait times is to conduct a survey of individual travel behaviour, and until the 1960s there were no such surveys in Australia. On the other hand line-haul speeds are a prime concern of public transport operators, and quite reasonable historical records are available.

Table 1.1 Average apportionment of time on journeys to work in Sydney 1971 (minutes per trip)

<table>
<thead>
<tr>
<th></th>
<th>In vehicle time</th>
<th>Walking time</th>
<th>Waiting and other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>20</td>
<td>4</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>Train/ferry</td>
<td>28</td>
<td>18</td>
<td>14</td>
<td>60</td>
</tr>
<tr>
<td>Bus</td>
<td>22</td>
<td>11</td>
<td>6</td>
<td>39</td>
</tr>
<tr>
<td>Walking</td>
<td>-</td>
<td>14</td>
<td>-</td>
<td>14</td>
</tr>
</tbody>
</table>

Source: Sydney Area Transportation Study tapes.

In 1854 the first suburban train in Australia ran from Melbourne to Port Melbourne in a little under 10 minutes, at a speed approaching 30 kilometres an hour. The following year
the first revenue train in Sydney slightly exceeded this speed on its run from Granville to Redfern (Preston 1980). These trains set an example to those which were to follow, and 30 kilometres an hour has been a typical suburban train speed ever since. Admittedly both the first trains were expresses, and in the early years of suburban train services stopping all stations trains would have been slower. However as the railways bought steam engines especially designed for suburban service local train speeds increased. Before the electrification of the Sydney suburban services in the 1920s stopping trains were scheduled at between 22 and 27 kilometres an hour, depending on the spacing of the stations and the severity of the gradients. The last steam suburban services in the country, in Brisbane and Perth in the early 1960s, were tabled at speeds up to 30 kilometres an hour for a stopping service, with expresses faster.

The electrification of the suburban railways - Melbourne between 1917 and 1923, Sydney between 1926 and 1929 - resulted in some acceleration of services, particularly of stopping trains, which were now timetabled at speeds of around 33 kilometres an hour, again with expresses faster. Speeds in Sydney and Melbourne have stuck at this level since much of the original electric equipment is still around and cannot be made to go faster. However when the Brisbane suburban electric service was inaugurated in 1979 with newer rolling stock stopping trains were scheduled at 39 kilometres an hour - a speed which the newer trains in Sydney and Melbourne could match given the opportunity.

On-street public transport in Australia began with horse buses and tramways - the first of the latter being opened in 1861 (Manning 1983:Ch 1). In Adelaide a speed limit of 8 miles an hour (13 kmph) was imposed on horse trams, and their service speed was around 10 kilometres an hour. Horse buses would have been if anything slower. Mechanical power arrived on Australian streets with the first of Sydney's steam tramways, opened in 1879. The steam trams were relatively fast, being scheduled at around 12 kilometres an hour in the inner industrial suburbs, and shooting through to Bondi at an overall speed of around 18 kilometres an hour - a speed which is respectable for buses even now. However the Sydney steam tramways had the disadvantage that service frequencies were generally quite low, and their relatively fast road speeds may have been dissipated in long walk/wait times (McCarthy 1981, Thomas, n.d.).

When the Melbourne cable tramways were first opened in 1885 they ran at horse tram speeds with schedules of around 10
kilometres an hour. However the need to cut costs in the depression of the 1890s spurred the management to speed the ropes, and henceforth the Melbourne cable trams ran at an average speed of 15 kilometres an hour (Keating 1970). (This reduced operating costs since a given frequency of service could be maintained with fewer trams.) As against the Sydney steam trams the cable cars were quieter and less polluting, and provided a much more frequent service. However their technical superiority was short lived, since electric tramcars, as soon as they had been developed to the stage of technical reliability, could do all the cable trams could do, and more, at less cost.

The first experimental electric tramway in Australia opened in 1889, and the first permanent system (the Hobart tramways) in 1893. The electrification of the Sydney tramways followed soon after, and within the next dozen years electric tramways were introduced in almost every Australian city. The early electric trams were timetabled at speeds similar to or even a little less than the steam and cable tramways: 14 kilometres an hour was typical in the years before the First World War, though this was exceeded on lines in the then outer suburbs, where 17 kilometres an hour was common. As against the cable tramways electric trams offered little improvement in service speed or frequency, which explains why Melbourne took until 1940 to substitute electric trams (and for some lines, buses) for its cable tram system. As against the steam trams they gave an increase in service frequency with no reduction in speed, and when replacing horse trams they resulted in an increase in speed with no reduction in frequency. In all cases they brought a reduction in operating costs.

The early petrol buses introduced before the First World War were no match for the trams as to speed or operating costs, but those available after the war were capable of matching tram speeds and fares. In most cities there began a few years of competition between government-owned trams and privately-owned buses, one result of which was an increase in tram speeds. A further increase in tram and bus speeds occurred during the depression of the 1930s, brought about by the need to reduce operating costs. The typical scheduled speed for trams at the end of the 1930s, around 18 kilometres an hour, was achieved by driving the old trams faster, rather than by buying new equipment. Bus services on suburban main roads were timetabled similar speeds, but there were at this time numerous local routes on the back streets of most cities, run more slowly by small private operators.

In most Australian cities the tramways were replaced by
buses during the 1950s and 1960s. The advocates of this change claimed that speeds would increase as a result, but in the event any increase was cancelled out by worsening traffic congestion and (later) by the switch from buses with conductors to those where the passengers paid the driver on boarding (Manning 1983:Ch 3). Bus and tram speeds in Australian cities are therefore nowadays much the same as they were in the late 1930s. However on most routes the frequency of service is rather less, particularly at nights and on weekends. Again, the services introduced in the new outer suburbs were almost invariably less frequent than those available in the older parts of the cities.

In summary, the main increase in public transport line-haul speed occurred when mechanically-powered transport was first introduced - though it took a little while for the potential of mechanically-powered on-street transport to be fully realised. Once mechanical power was in use quite major technical changes could take place with little effect on speeds. Only a modest increase in speed resulted from the electrification of the suburban railways, and no increase at all from the change from trams to buses. On the other hand, several minor increases in speed were achieved without technical change at all, including the speeding up of the tramways during the 1930s and more recently the provision of bus lanes. On the whole, however, public transport line-haul speeds have been remarkably constant since the turn of the century.

It must always be remembered that around half the duration of a typical public transport trip is taken by walk/wait time. We have no direct evidence as to whether walk/wait times in the past were longer or shorter. Waiting times may be affected by service frequency, and in so far as service frequencies have declined over the past few decades waiting times may be longer - but on the other hand, most public transport trips are made at times and along routes where frequencies have not declined. Again, a significant number of train travellers nowadays reduce their walking time by driving to the station. It is thus possible to put various hypotheses, but they can go either way, and the likelihood is that walk/wait times now are not very different from those 50 or 80 years ago. On the other hand, there have been quite significant changes in fare levels and costs.

Public transport fares and patronage

To gain access to the public transport system individual users do not have to make any capital investments, the entire cost being expressed as a fare payable for each single journey,
or a periodical ticket valid for periods of up to a year. By the 1970s fares were not a major item in consumer budgets except perhaps for long-distance rail commuters to the city centres of Sydney and Melbourne. With lower wages in the past they were much more significant. In the 1890s low-income workers walked long distances because they could not afford to ride even at workmen's fares, and as late as 1911 fares were of such concern that the Victorian Government appointed a Royal Commission to investigate why Melbourne tram fares were higher than Sydney.

The history of fares is best described in conjunction with the history of public transport patronage, since the two have influenced one another. Chart 1.1 shows the number of passengers carried each year in the five largest Australian cities. The topmost line for each city shows the total number of public transport passengers, and the other lines divide the total between the main kinds of public transport. The same vertical scale is used for each city to facilitate comparison between cities as well as over time. It is obvious that the absolute number of passengers carried in any city depends on its population, and to adjust for this Chart 1.2 shows journeys per capita. On the basis of these graphs the history of Australian urban public transport can be divided into four periods. First, during the 1880s traffic in the two largest cities grew rapidly from a small base, while during the 1890s there was a slump in Melbourne and continued but slower growth in Sydney. At about 160 journeys per head each year patronage was well below the heights reached later. Second, in the years between Federation and the First World War there was strong growth in patronage, and in Sydney, Melbourne and Brisbane it peaked at 400 or 500 hundred journeys per person per year - not far off the level which would be reached if each man, woman, child and baby made one return trip every weekday. Patronage in Adelaide and Perth never reached these heights, perhaps because these were small cities in which cycling remained popular.

During the third period, from the First World War to the all-time peak patronage at the end of the Second, the trend in passengers carried was generally upwards, reflecting population growth. Even so, traffic fell during the depression. Journeys per capita went down gently in some cities (Melbourne, Brisbane) and abruptly in others (Sydney, Perth) but revived during the subsequent war. However from a peak in about 1946, patronage has fallen away steadily both in absolute and per capita terms, with the recent exception of that rapidly growing upstart city, Canberra.
Chart 1.1 Public transport passengers carried in Australian cities 1881-1978

1.1 (a) Sydney

1.1 (b) Melbourne

1.1 (c) Brisbane

1.1 (d) Adelaide

1.1 (e) Perth

GRAPH

Public transport passengers carried in Australian cities (million journeys a year, cumulated)
Chart 1.2: Public transport journeys per capita 1881-1975

Journeys per capita per annum

- Sydney
- Brisbane
- Adelaide
- Melbourne
- Perth
- Canberra

1890 1900 1910 1920 1930 1940 1950 1960 1970
These trends can be ascribed to several factors, among them the fares charged. The history of fares in Sydney and Melbourne is summarised in Chart 1.3. The tram/bus fare index applies to a constant distance of 4 kilometres, while rail fares are represented by an index adjusted for the changing proportion of periodical tickets and of journeys of different lengths. The indices have been deflated by the consumer price index, and show the movement of fares by comparison with the general run of prices. In outline the history of fares, like the history of patronage, is similar for the two cities, and should be
fairly typical of events in the smaller cities. Even so, Melbourne fares were generally above Sydney, particularly before the First World War when the Sydney tramways were government operated as against the private concessionaire who ran the Melbourne cable lines (Manning 1983 Ch. 1). This helps to account for the higher level of patronage in Sydney.

With the electrification of the Sydney tramways there was a spectacular reduction in fares - they fell to less than half - and the Melbourne cable tramways followed suit with a small reduction. Fares were then held constant in the face of a general slow inflation, and so fell further in relation to general prices. Falling fares go a long way towards explaining the increase in patronage that took place in Edwardian times. In their turn by economies of scale the patronage increases helped to keep fares low.

By 1920 fares had fallen very low indeed. In 1921 they were increased without any disastrous effect on patronage, and remained fairly close to the level thus gained for the best part of three decades - the years during which patronage remained high, with fluctuations due to economic circumstances. The fall in patronage during the depression was mainly due to unemployment, but may have been worsened by the fact that fares were held constant in a time when other prices were falling, thus raising their relative level. In Sydney there were fare reductions in 1933, but the Melbourne authorities held their fare scale, only to see its level eroded gradually by the increase in other prices during the late 1930s.

After the Second World War the graph takes on a sawtooth appearance, with fares being raised every so often as public transport operators attempted to compensate for inflation. Worse, from the mid 1950s onward the former relationship between low fares and increasing patronage went into reverse. Traffic was now falling due to competition from motor cars, and falling traffic meant the sacrifice of economies of scale with resulting increases in costs per passenger. This put the public transport authorities in a bind: should they maintain low fares and try to meet the competition, or should they raise fares to cover cost increases? The former course would only be possible if there were subsidies, and since these were limited the authorities were forced to raise fares relative to other prices. This was particularly the case for tram/bus fares - rail fares did not rise so much. It is noticeable that the reductions in rail patronage were not so severe, but whether this was cause or effect of their lower rate of fare increase cannot be determined from this evidence. It might be argued that rail, with its higher speed, was more able to compete with
the motor car and hence retain its patronage, whence there would be less need to raise fares to cover the diseconomies of falling scale. On the other hand, the railways could for a time offset deficits on their suburban passenger service against a profitable business in long-distance freight, and again the outer suburban long-distance commuters exerted political force to slow the rise in rail fares.

The emergence of the deficit in the case of the conservatively-managed Melbourne and Metropolitan Tramways Board can be traced from Chart 1.4. Here the fare index has been smoothed by taking the average value for each year, and deflated by an index of average wages instead of prices in general. From the passengers' point of view this shows the trend of tram fares in relation to income; from the Board's point of view it shows the trend in relation to the major cost of operating its services. The graph emphasises the extent of the fall in fares in the early twentieth century - no wonder patronage increased. It then shows an increase during the depression (constant money fares and falling wages) and a gentle fall thereafter (constant money fares and rising wages). The fare increases of the late 1950s produced a rise in fare levels relative to wages, but those thereafter merely kept up with wage increases until an attempt to maintain fares constant in terms of the general price level produced a fall in the index in the mid 1970s.

Chart 1.4 also shows the operating cost per passenger carried. This includes no allowance for interest or other capital charges, but can still be taken as a rough indicator of the Board's profitability. It can be seen that in the years up to 1950 the trams were mildly profitable; in the years thence to 1971 (when the Board undertook to limit fare increases in return for a subvention from the state government) they more or less covered their operating costs, and since then have operated at a considerable deficit. These trends can be related to two other indices: the number of tram miles per route mile each year (which gives a rough indicator of the frequency of service) and the number of passengers per tram kilometre run. These provide the link between costs (which vary with tram kilometreage) and revenue (which varies with the fares charged and the number of passengers carried).

It can be seen that the Board maintained its profits during the depression by reducing the frequency of service and increasing the level of fares relative to wages enough to cover the remaining fall in patronage per tram mile. During the Second World War it continued to operate profitably despite fares which were falling in terms of wage costs since it was
able to handle much increased traffic without any great increase in service frequency. (The customers paid some of the costs in terms of increased crowding.) After a strike in 1950 there began a period when declining patronage was met by cost-cutting in terms of reduced service frequency. The reduction was not quite enough to prevent a slow decline in the number of passengers per tram mile, and at fares which were constant in terms of wages the deficit rose slowly. This was, however, mild compared to the position from 1973 onwards. By this time it was judged impolitic to reduce service frequencies any further and for similar reasons fare increases were moderated. The number of passengers per tram kilometre rose a little in times of constant money fares, and continued to fall otherwise. Costs per passenger continued to drift upwards in relation to the general wage level, and since fares had now fallen in relation to wages the result was a sizeable deficit.

Chart 1.4 Melbourne tram fares and costs deflated by a wage index 1901-1978

Source: MMTB Annual Reports
SPEED AND COST

This story has been told in detail only for the Melbourne tramways, partly for convenience (the Board's accounts have been well and consistently kept) and partly for simplicity (there were few complicating factors like changes in management or technology). Even so, the financial history of other public transport operators is similar. Deficits emerged at an earlier stage on the Sydney buses, while the private buses in the outer suburbs of the various cities resorted to service cutting on a greater scale, to the point where they were taken over and incorporated into the government system in Perth and Adelaide, and were subsidised to a greater or lesser degree in the other cities. The history of suburban rail services is probably again similar, but is harder to trace for lack of accounts separating suburban services from the others. Indeed it was not until the 1970s that it became possible to compare costs as well as revenues for rail and on-street public transport.

Once again the situation in Melbourne can be taken to represent the other cities (Table 1.2). The average suburban rail journey was about 16 kilometres in 1976–7, five times the length of the average tram or bus ride, yet the difference in fares per passenger was a mere 12 cents (39 rather than 27). This meant that rail fares were cheaper per kilometre travelled than tram/bus fares, due mainly to the taper in the fare table, and to the railways' range of concession and periodical tickets. Railway operating costs were also less per passenger kilometre, such that the subsidy per passenger kilometre was about the same for the trains and trams, though the railway subsidy per passenger was much greater.

The lower level of railway operating costs per passenger kilometre compared to trams or buses reflected the potential the railways have for spreading their labour costs over a large number of passengers. In Melbourne a train with 500 seats required a driver and a guard, the same number of men as a tram with 50 seats. The railways' chief cost disadvantage lay in the plethora of station attendants - a requirement which did not vary greatly with the number of trains run. Accordingly there were considerable economies of scale in train operation. Reflecting heavier traffic, the costs per passenger kilometre of providing rail travel in Sydney were under Melbourne (4.2 as against 5.8 cents) while in lightly-trafficked Adelaide costs were much greater (8.5 cents).

A similar explanation can be given for the lower operating cost of trams per passenger kilometre compared to government buses. Trams are bigger, and crew/passenger ratios can be lower. However, the costs of private bus operation were similar to the trams, despite their serving the lightly
trafficked outer suburban routes. This was not due to heavy loadings, but reflected mainly a greater flexibility in the use of labour, with drivers doubling as mechanics and clerks in the off-peak periods (Gilmour 1974). As a result the subsidy to private buses was relatively small both per passenger carried and per passenger kilometre.

Table 1.2 Public transport fares and costs
Melbourne 1976-1977

<table>
<thead>
<tr>
<th></th>
<th>Cents per journey</th>
<th>Cents per passenger-km.</th>
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<tbody>
<tr>
<td></td>
<td>Fare</td>
<td>Operating cost</td>
</tr>
<tr>
<td>Suburban train</td>
<td>39</td>
<td>94</td>
</tr>
<tr>
<td>MMTB tram</td>
<td>26</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>58</td>
</tr>
<tr>
<td>private bus</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>taxi</td>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

Source: VR Annual Reports (with some interpolation from 1977-8 figures) MMTB and TRB(V) Annual Reports.
Average journey length for tram/bus passengers by assumption supported by an analysis of fare tables.
Average taxi passenger occupancy assumed at 1.5.

Finally, the cost of taxi travel, with its low ratio of passengers to crew, was decidedly above the other public transport modes. Given the absence of a subsidy the level of fares was higher still.

Cycling

The modernisation of private transport began in the 1890s with the introduction of the safety bicycle, of a design basically unchanged today. Like walking speeds, cycling speeds can vary a great deal between individuals. A slow cyclist travels about double walking speed, say around 10 kilometres an hour, while a fast rider, with head down and bottom up, can average 25 kilometres an hour without entering the racing league. In flat country, in the absence of headwinds and on paths free from traffic congestion, cycling can be highly competitive with public transport speeds, and can even match the motor car (de Donea 1971:84). Historically, improvements in road paving have aided cyclists, but the increase in congestion caused by motor traffic has hindered and endangered
By contrast with walking, cycling can be more expensive than many people realise, and not only because cycles are easily stolen. Their price in Australia is still sufficiently high to deter deserted wives and other poor parents from buying bikes for their children. If the push bike be compared with public transport, the regular traveller who stops using the bus and buys a new cycle may not be ahead financially until he has ridden a thousand kilometres or so. In Edwardian times in Australia the comparison was even less favourable – the purchaser of a new bicycle did not break even until 4,000 kilometres, and this without any allowance for repairs and maintenance. However, in the late nineteenth century, when the modern bicycle was first introduced, tram fares were higher and trams (especially horse trams) were slower than in the decade before the First World War, so it is not surprising that there was a cycling boom. Even so, it is unlikely that it extended to the children of the working class, for judging by the prices in contemporary newspaper advertisements a new bicycle cost two or three weeks of a labourer’s wages.

Motoring speeds

It is notoriously difficult to quote representative motoring speeds for city travelling. To begin with, some drivers prefer to jog along slowly, while others enjoy taking risks. More important, the state of the traffic varies on different streets, and on any particular street varies broadly by the day of the week and by time of day, but with vagaries that are not as predictable. Motorists who travel in the peak period report that a journey which normally takes half an hour can easily extend to 40 minutes, while a good run may sometimes be had in 20. In these circumstances the calculation of average speeds involves statistical finesse. It was only in the 1960s that the road authorities adopted and systematically used the floating car method for estimating the average speed of cars on a particular road. Again it was only from 1960 onwards that the home interview technique has been used for estimating overall travel speeds. By this technique people are asked to record the origin, destination and time taken for trips made the previous day, and computer calculations can then provide the average speed.

The investigation of road speeds by the floating car method has confirmed various unsurprising facts: speeds are less in the peak periods, and vary across the typical metropolitan area quite markedly. In the peak period it is common for speeds on
inner area main streets, and perhaps on other bottleneck sections, to be around 20 kilometres an hour, while on outer suburban main roads the average speed can be greater than the speed limit for the road, with averages of around 80 kilometres an hour being recorded. Historical comparisons for the decade or so in which the free floating car technique has been in use tend to show constant or declining speeds on any particular road, but this need not imply that speeds are falling for the metropolitan area as a whole (Daly 1977). New freeways have been opened from time to time, generally with an increase in speed on the new road and on the roads it relieves of traffic. Again the balance of traffic is gradually shifting to the outer suburbs where speeds are faster.

The household interview survey technique gives information not only on the average road speed achieved on motoring journeys, but on the walk/wait time involved as well. Walking and waiting do not usually contribute as much to the total duration of car trips as they do to public transport trips, but the time taken is significant, and can easily approach a third of the total time taken for a trip to the shops. Waiting time for motorists is generally spent in getting into the car and starting it, and in parking it at the other end of the trip. Walking time arises because it is not always possible to park at the exact destination. In Sydney in 1971 a car trip typically involved around 7 minutes walking and waiting - significant, though noticeably less than bus trips (17 minutes) or train trips (32 minutes). The walk/wait times associated with motoring have probably increased since cars were first introduced, since in those days kerbside parking at the destination was usually possible. The first complaints about parking difficulties were heard in the 1920s, while in the 1950s the complaints became general and great efforts were made by businessmen and local councils to increase the provision for car parking. Even so, the large car parks that are now necessary at major destinations often imply noticeable walking times just to cross the car park itself.

The household interview technique also provides information on average speeds. These turn out to be quite low - 33 kilometres an hour for all weekday car trips in Sydney in 1971, a speed similar to that of an all-stations suburban train. Most motorists probably estimate that they travel faster than this, but even when they keep the needle of the speedometer close to 60 kilometres an hour whenever possible they are inevitably held up at traffic lights or waiting to make right hand turns, and also have to travel more slowly in shopping centres and on local streets. However, the faster speeds
SPEED AND COST

attained on outer suburban roads show up in the household interview results. In Sydney in 1971 the average motoring speed achieved by inner suburban residents was of the order of 30 kilometres an hour, while outer suburban residents travelled on average at about 40 kilometres an hour (Manning 1982:514-5).

Though we thus have reasonable information on motoring speeds currently achieved, the history of motoring speeds is a matter of speculation. Improvements in motor vehicle engineering and in road construction have made for higher speeds, offset by increasing congestion. Central city congestion has been a matter of motorist complaint since the 1920s, and from the 1950s on there have been complaints of delays at numerous suburban locations. The fall in peak hour bus speeds in Sydney from the 1950s on gives an indication of the seriousness of increasing congestion in that city. However, as previously noted, the balance of traffic has been shifting into the outer suburbs, where speeds are faster. On the whole, therefore, it seems quite likely that average motoring speeds have not varied very much since cars were first mass produced in the 1920s.

The relative speed of the different transport modes is summarised in Chart 1.5, which gives the average relationship between distance covered and time elapsed for Sydney in 1971. This can be taken as typical of Australian cities for most of this century (though there is evidence that walk/wait times for train trips are shorter elsewhere, since in the other cities fewer train trips involve interchange with buses). The chart implies that in the average case walking is the fastest means of transport for journey distances of up to 700 metres, and motoring generally the fastest thereafter; cycling is generally faster than public transport for distances of up 12 kilometres; walking is likely to be faster than public transport for trips of up to 2 kilometres, and bus is likely to be faster than train for journeys of up to 8 kilometres. All of these are average relationships, and may not apply in particular cases. Congestion and parking problems may reduce the relative speed of motoring, while the competitive position of public transport depends very much on the existence of suitable routes for the particular journey. Even so it is indubitably slower for most trips, and depends for its patronage on people not being able to drive, and on charging fares cheaper than motoring costs.

**Motoring costs**

Walking is free, and the price of public transport is a relatively straightforward fare, but the price of motoring to the car traveller is inherently complicated. Instead of paying
an all-in price, the motorist makes separate payments for vehicle purchase, registration and insurance, and running expenses including fuel, oil, tyres and repairs. Registration is a fixed charge and must be paid by every car owner, but the purchase cost can be minimised by buying a cheap old car.

Chart 1.5 Time spent and distance covered for typical journeys, Sydney 1971

Source: Sydney Area Transportation Study tapes.

Petrol costs can be reduced by buying a small car, and repairs by buying a new car or supplying one's own labour. For the motorist who does not wish to chalk up high annual mileages total costs are minimised if he buys a cheap old car, but if he wishes to drive long distances the cost of repairs may catch up and it may be cheaper to invest in a new vehicle. Motorists do in fact respond to these incentives. In Melbourne in 1975 cars one to five years old were driven 39 kilometres a day on average, as against 19 kilometres for cars over 15 years old (Lawlor 1978:4). This is partly explained by the fact that the newer cars were often in business ownership. The obvious further deduction, that old cars had low-income owners seeking
cheap short-distance motoring, is however incorrect, since the household expenditure survey of 1974-5 showed that motoring expenses per car were similar for all income groups apart from those on pensioner incomes (Table 1.8). The only noticeable differences were that petrol was slightly more important for low-income motorists, and repairs slightly less, suggesting that low-income owners economised by doing some of their own maintenance.

A further deduction from Table 1.3, involving the perhaps debatable assumptions that petrol was available to all households at the same price and that the fuel consumption of cars did not vary with household income, was that the average mileage driven per car varied very little with household income. The average annual mileage of 13,400 kilometres so calculated for the capital cities accords well with other surveys of cars owned by households (Lawlor 1978; SATS) though not with the Survey of Motor Vehicle Usage, which estimated an average annual mileage of around 15,000 kilometres. The difference was probably due to the inclusion of business cars in the latter figure.

The lack of variation in average motoring costs per car with household income is important, for it suggests that people buy motoring as a fairly standard package, in which purchase costs and running costs are kept in a similar proportion and reach a similar total for households of all kinds. The cost of motoring is thus best evaluated as the cost of this standard package.

In addition to the evidence from the household expenditure survey, two other observations support the proposition that motoring comes as a standard package. The first is that the mileage driven per car has increased very little over the years, despite increases in incomes and reductions in the cost of motoring relative to other prices. The second is that mileage per car is remarkably similar in quite different cities.

According to estimates by the New South Wales Department of Main Roads, the average motor vehicle in that state during the prosperous pre-war years was covering annual mileages about 25 per cent less than today (Endnote 1.) During the depression the average distance was, however, much less. Between 1929-30 and the next year, petrol sales fell by 38 per cent due to the deregistration of cars and a reduction in the distance driven in those which remained registered. By contrast public transport patronage fell away by less than 20 per cent. Motor cars in those days were still a luxury which could be sacrificed in times of financial stress.
<table>
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<tr>
<th></th>
<th>Weekly &lt;$80</th>
<th>Weekly $80&lt;$140</th>
<th>Weekly $140&lt;$200</th>
<th>Weekly $200&lt;$260</th>
<th>Weekly &gt;$260</th>
<th>Total</th>
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<tbody>
<tr>
<td><strong>Motoring expenditure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per household $/week</td>
<td>5.38</td>
<td>14.25</td>
<td>19.50</td>
<td>25.09</td>
<td>35.01</td>
<td>21.64</td>
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<tr>
<td>Households with cars %</td>
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<td>75</td>
<td>83</td>
<td>92</td>
<td>97</td>
<td>75</td>
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<tr>
<td><strong>Motoring expenditure per motorist household $/week</strong></td>
<td>13.00</td>
<td>18.50</td>
<td>23.00</td>
<td>27.00</td>
<td>36.00</td>
<td>27.02</td>
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<tr>
<td><strong>Cars per motorist household</strong></td>
<td>1.03</td>
<td>1.09</td>
<td>1.22</td>
<td>1.38</td>
<td>1.84</td>
<td>1.42</td>
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<tr>
<td><strong>Expenditure per car by motorist households $/week</strong></td>
<td>12.50</td>
<td>17.00</td>
<td>19.00</td>
<td>19.50</td>
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<tr>
<td>Expenditure on fuel per car $/week</td>
<td>3.00</td>
<td>3.90</td>
<td>4.50</td>
<td>4.50</td>
<td>4.10</td>
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<tr>
<td>Distance travelled per car km/year</td>
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<td>12,400</td>
<td>14,600</td>
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### PERCENTAGE OF MOTORING EXPENDITURE

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<th>Weekly &gt;$260</th>
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<tr>
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<td><strong>Registration &amp; insurance</strong></td>
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<td>14</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>13</td>
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<tr>
<td><strong>Fuel</strong></td>
<td>24</td>
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<td>24</td>
<td>23</td>
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### PERCENTAGE OF AVERAGE HOUSEHOLD EXPENDITURE

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<th>Weekly $140&lt;$200</th>
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<tr>
<td><strong>Motoring expenditure per car</strong></td>
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<td><strong>Spending on fuel</strong></td>
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<td>4</td>
<td>4</td>
<td>4</td>
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### PERCENTAGE OF AVERAGE HOUSEHOLD INCOME

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<th>Weekly $200&lt;$260</th>
<th>Weekly &gt;$260</th>
<th>Total</th>
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<tbody>
<tr>
<td><strong>Motoring Expenditure per car</strong></td>
<td>26</td>
<td>15</td>
<td>11</td>
<td>9</td>
<td>5</td>
<td>9</td>
</tr>
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</table>

Source: ABS Household Expenditure Survey.  
Car ownership interpolated from the Sydney Area Transportation Study (1971) and Metropolitan Adelaide Transportation Study (1976).
The mileage per vehicle recovered more rapidly than registrations, and was back to pre-depression levels by 1935, only to be reduced by petrol rationing during the Second World War. It recovered during the 1950s, and during the 1960s it rose by a further 20 per cent to level off in the 1970s. By this time most of the growth in car ownership was in second cars and business cars.

From 1950 to 1978 petrol prices in Australia fell relative to other prices while wages rose, till by the mid 1970s the price of petrol relative to wages was only 20 per cent of its post-war level. Similarly the roads and the comfort and capabilities of motor cars were improved. All these constituted a substantial incentive to increased mileages, and it is therefore surprising that the rise was so small. However, the historical record is corroborated by Zahavi's observation that the mileage driven annually in an average car did not vary greatly in a sample of cities across the world (Endnote 2). An average car in three American cities, and Sydney and in three Third World cities was being driven between 30 and 36 kilometres each weekday, despite differences between the cities in average income levels and in the relative prices of the components of the motoring package.

We may conclude that motorist behaviour is not very sensitive to changes in the prices of the components of the standard motoring package, or indeed to the cost of the package as a whole. However the cost of the whole standard motoring package has an obvious relevance to whether a person can afford to become a motorist. How has this cost varied? The fall in petrol prices in relation to wages has already been mentioned (Chart 1.6). The fall began in the period up to 1925, due to the introduction of bulk handling and to improvements in refining. Petrol prices then remained fairly constant in relation to wages until the end of the Second World War, when there began a steady fall which was only arrested with the introduction of import parity pricing in 1978. The price increases of that year were sufficient to take petrol prices in relation to wages back to their level of the late 1960s - not a very drastic change considering the publicity given to the energy crisis.

The purchase price of cars also declined greatly in relation to wages. It fell in the years to 1925 as mass production was introduced, then stabilised for two decades. (On Chart 1.6 the car price index disappears during World War II because new cars were not available.) The post-war reduction in the real price of cars was not quite as spectacular as the fall in petrol prices, but even so by the mid 1970s cars were selling at a
price in relation to wages only 25 per cent of their immediate post-war price.

Chart 1.6 Sydney car and petrol prices deflated by wage index

Source: Department of Economic History, Research School of Social Sciences, Australian National University.

Long period price indices are not available for the other two major components of the standard motoring package - repairs and registration (including insurance). However during the 1970s trends in these motoring costs counterbalanced much of the decline in the prices of cars and petrol, such that the decline in the total motoring package, in relation to wages, was around 33 per cent. Over the longer run repair costs are likely to have reflected wage levels, and insurance charges to have reflected repair costs. On the other hand, the registration fees quoted in the various state yearbooks have fallen in relation to wages to about the same extent as the price of cars and of petrol. On these figures the cost of the standard motoring package fell post-war from approximately 40 per cent of average weekly earnings to the present figure of around 13 per cent. It is not surprising that many people found themselves able to afford a car during this period.

Given the composition of the standard motoring package it is also possible to calculate the average cost of motoring at approximately 9 cents per car kilometre travelled (1976-7 prices). The cost would have been substantially more for some low-mileage luxury cars, and somewhat less for small cars whose owners carry out their own maintenance. This estimate, being derived from the expenditure survey and including only current cash costs, is noticeably less than the estimates of car operating costs put out by the motoring organisations (e.g.
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costs in April 1976 for cars averaging 16,000 kilometres a year ranging from 14 to 28 cents per kilometre, depending on car size) but is representative of the costs incurred by the average motorist, and as such can be used in a comparison of motoring costs with public transport fares.

Given operating costs of 9 cents per car kilometre the cost per passenger kilometre depends on car occupancy, and with five people on board could go as low as 1.8 cents per passenger kilometre, well below the level of public transport fares. However cars seldom go round fully loaded, typical average occupancies in Melbourne varying from 1.2 people for work travel up to 2.8 for social/recreational trips (Lawlor 1978:46). The corresponding cost range would be from 7.5 down to 5 cents per passenger kilometre, figures comparable with the 1976-7 level of bus fares and roughly double rail fares. It should, however, be remembered that these are the full costs, and that motorists tend to consider only the cost of petrol when deciding whether or not to use the car for a contemplated trip. Petrol came to about a quarter of total motoring costs, and even after the price rises of the late 1970s would not have accounted for more than a third of costs. Accordingly, it can be seen that the cost advantage on which public transport had hitherto relied to compensate for its slower speeds, and which as late as 1960 had been quite marked, had by the 1970s disappeared, or was at the most being precariously maintained by subsidy. Indeed, according to normal commercial logic public transport should have disappeared, but various dissatisfactions with universal motorisation caused services to be maintained.

Given that relative prices changed in favour of fast private transport, we should expect it to have become vastly more popular. What further can be said about the rise of motoring?

Car ownership

Unfortunately it is not possible to describe the rise of motor transport in full statistical detail comparable with the documentation of public transport trips, since returns have never been regularly compiled on the number, cost, distance or duration of motor trips. The best indicator available is the number of vehicles on the road. This should be satisfactory, since we have already argued that the distance travelled per car has not changed much.

Unlike the horses and buggies they replaced, motor cars had to be registered, and the number on the register gives an idea of how many were on the road. Unfortunately in most states metropolitan and non-metropolitan registrations were not
distinguished, but in Western Australia separate figures are available from 1938 onwards. Chart 1.7 accordingly records the introduction of cars into Western Australia up to 1938, and into Perth from then on. It can be seen that before the First World War the motor car was a plaything of little consequence, too few in number to have much effect except in frightening horses. However, during the 1920s the number on register increased to the point where there were about 7 cars for every 100 people in Western Australia. This was enough for nearly a third of all households to have a car. Since cars were expensive, these were upper-income families, and in the politics of the time the upper income groups had an interest in the improvement of the roads whereas the lower income groups were more interested in improved public transport.

The young workman's alternative to car ownership in the 1920s was to own a motor bike. According to a contemporary observer:

'Long before motor cars came within reach of youths or working class people of any age, motor-bikes were generally attainable and popular ... With petrol at eighteen pence a gallon and a small machine doing seventy miles a gallon it was within the reach of all the youths of the 1920s ... If you were earning big money for a youth - say two pounds a week with no board to pay at home, then you could afford a side-car outfit to accommodate the girl friend'. (Davies 1978:21, 148)

Indeed deluxe sidecars were available with dicky seat, the ensemble costing almost as much as a small car. However, the rigors and dangers of motor cycling made it unattractive to the staider members of the community.

During the depression there was a slump in the number of cars on the road, and then during the late 1930s a recovery which was cut short by the Second World War. Not only were new cars unobtainable, but in response to petrol restrictions a great many cars were deregistered. It was not until 1949 that the number of cars per capita in Perth returned to its 1930 peak. However, from this time onwards the car population grew rapidly and consistently, until by 1977 there were over four cars for every ten people in Perth, plus an assortment of other motor vehicles.

While there may have been differences of level and detail, the evidence is that the trend of motor registrations was similar in all Australian cities. During the years before the First World War there were very few cars on the road. Most
private vehicles were horse-drawn, though of their actual numbers we know little. Between 1918 and the end of the Second World War the number of cars rose, then fluctuated, but the post-war decline of public transport was accompanied by a steady increase in motor car ownership. Though the motor car was brought to a reasonable level of technical reliability seven or eight decades ago, and though it was first mass-manufactured six decades ago, mass motorisation dates only from the end of the Second World War.

The rise of motoring and decline of public transport

We have seen that the post-war history of public transport was one of rising costs and falling patronage, while that of the motor car was a success story of falling costs and rising ownership. It remains but to give a connected account of how the decline of public transport tied in with the rise of motoring. The best Australian records of this change were kept in Sydney.

Walking aside, at the end of the Second World War the main means of getting about Sydney was public transport. According to the Cumberland County Council which had arranged surveys of road traffic and collated their results with public transport traffic returns, only 13 per cent of all trips in Sydney in 1946-7 were by private car (Endnote 3). This figure was depressed by petrol rationing, but even so the change over the next three decades was enormous. Private and public transport changed places; the minority means of transport became the majority (from 13 per cent of vehicular trips to over 70 per cent) and the other way about. Perhaps no more need be said,
yet it would be informative to have a little more detail of the
course of events over time. To what extent was the trend
already noticeable pre-war? And is it tapering off or
continuing?

A continuous record is maintained of traffic by both public
and private transport crossing the Sydney Harbour Bridge. Car
collectors and train, tram and bus passengers are shown
separately in these tollgate records, and only pedestrians and
cyclists omitted (Chart 1.8). The first notable trend is that
the total number of people crossing the bridge increased
greatly during the five decades since its opening. The
increase was faster than the rate of growth of Sydney's
population, and would probably have been greater still had
motor traffic during peak periods not been limited by
congestion both on the bridge and on its approach roads. This
suggests that the people of Sydney travel about more than they
used to, though increasing traffic on the bridge may reflect
changes in the pattern of traffic rather than an increased rate
of trip-making.

Road congestion on the bridge means that the toll records
underestimate the extent of the switch from public to private
motor transport in Sydney as a whole. People whose journeys
involve crossing the Harbour are more likely to use public
transport than others. Even so, in the early 1970s the number
of bridge crossings by public transport was little more than
1.5 times the 1933 figure - a decline from the peak level
reached during the war - while crossings by car were running at
over 15 times their rate when the bridge opened. This increase
in motor traffic, like the increase in motor registrations,
ocurred mainly during the post-war period. The number of
people crossing the bridge by car rose during the late 1930s,
but fell to an all-time low during the years of petrol
rationing, only to increase rapidly from 1946 onwards.
Altogether these figures from the Sydney Harbour Bridge tell
much the same story as the patronage returns of public
transport and the motor registration figures. However, they
tell us nothing of the situation before the bridge was opened
in 1932.

Some idea of conditions in the 1920s can be gleaned from the
traffic counts carried out in 1926 at a number of important
junctions in suburban Melbourne. Trams and buses comprised
about 8 per cent of the vehicles counted, cycles 16 per cent,
goods vehicles 24 per cent and other passenger carrying
vehicles, both motor and horse-drawn, accounted for the
remaining half of total traffic (Metropolitan Town Planning
Commission 1929:20). Excluding goods vehicles and adjusting
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for the reported occupancy of the rest it can be estimated that two-thirds of the people crossing these junctions were carried in buses and trams, 20 per cent in motor cars and 4 per cent in light horse-drawn vehicles, while 5 per cent rode push bikes and a small remainder rode motor bikes. Thus by the mid 1920s the motor had almost displaced the horse as motive power for passenger transport but trams and buses were the main on-street means of transport apart from walking. Considering that 10 per cent of Melbourne's workers cycled to work in 1951 (Table 1.4) the proportion of cycle traffic in 1926 is surprisingly low, but even then cyclists were probably avoiding major road junctions.

Chart 1.8 Passengers crossing the Sydney Harbour Bridge, by means of transport, 1933-1973

Source: Department of Main Roads (NSW): Reports

Transport modes and the journey to work

One of the major reasons for travel within urban areas is the journey to work. Journeys to and from work were responsible for around half the total person-kilometres of travel in Sydney on weekdays in the 1970s (Manning 1978). Worse, much of this travel occurs during the two daily peak periods. Work travel is thus responsible for much of the strain placed on the transport system, and as a result has been studied more than most kinds of journey.

The best data on the switch from public transport to the motor car for the journey to work comes from a series of surveys in Melbourne. These are summarised in Table 1.4. In 1951 public transport was already past its peak, but still
carried the greater part of the traffic, being used by 56 per cent of all workers. The remaining workers were divided fairly equally between the private car (20 per cent) and non-mechanical transport (21 per cent). At a second survey 13 years later the most significant change was the increased proportion of motorists, whose numbers had gone up not only at the expense of public transport but particularly at the expense of cycling. It could be argued that the cyclists gave up because of danger from the increasing motor traffic. On the other hand, it may be that workers cycled mainly when their journey was too far to walk and there was no public transport available, in which case they would quickly abandon their cycle once they could afford a car.

Table 1.4 Means of transport used on the journey to work

<table>
<thead>
<tr>
<th>Year</th>
<th>Rail</th>
<th>Tram/bus</th>
<th>Car</th>
<th>Pedal cycle</th>
<th>Walk at home</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>26</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>1964</td>
<td>18</td>
<td>18</td>
<td>50</td>
<td>2</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>1970</td>
<td>16</td>
<td>14</td>
<td>58</td>
<td>1</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>1974</td>
<td>12</td>
<td>11</td>
<td>66</td>
<td>1</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>

Sources: 1951 Borrie et. al. 1954:192. Allowance of 3 per cent for working at home by assumption. 1964 Wilbur Smith 1969. 1970 Recalculated from ABS: Journey to Work and Journey to School. (The ABS category 'other' has been split between 1974 'work at home' at 1964 levels and 'car', on the assumption that workers with no fixed workplace will generally travel by car.)

The figures for 1970 and 1974 chronicle the continuing decline of public transport, the somewhat slower decline of the proportion walking to work, and the corresponding rise in the use of cars.

Unfortunately there are no comparable surveys pre-war. However, from the patronage returns of public transport it is possible to estimate how many people used trains, trams and buses to get to work in the years back to Federation and even earlier. The total number of people journeying to work can be estimated independently from the censuses. The difference between this total number and the number travelling by public

33
transport will be due to workers who walked, cycled or rode in motor cars, plus whatever errors have crept into the calculations. Such estimates are shown for Melbourne and Sydney in Chart 1.9. These two charts are the product of statistical assumptions which bordered on the foolhardy (Manning 1979) and should be treated with a certain wariness, but the main trends are so strong that they outweigh any likely statistical inaccuracies. The general pattern of change is similar for both Sydney and Melbourne. In both cities the growth of total work journeys reflected the growth of the workforce, except during the depression of the 1930s, when unemployment reduced the number of people travelling to work, and the few years immediately after the Second World War, when the working week was reduced from six days to five in most trades.

The history of transport choice for work travel is again similar in the two cities. At Federation about a third of all work journeys were made by public transport, and the same was again true seven decades later, but in the meantime the proportion using public transport had risen and fallen, in Sydney perhaps surpassing two-thirds. At Federation most of those who did not use public transport either walked or cycled, but in the 1970s those who disdained train, tram and bus mostly travelled by car. Thus up to about 1910 (a little earlier in Sydney) the majority of workers walked or cycled to work, thence till about 1960 (a little earlier in Melbourne) the majority used public transport. Since then motoring has been the most popular way of getting to work.

Though Chart 1.9 applies strictly only to the journey to work, there is every evidence that the trends it shows in modal choice applied to other kinds of trip as well. It is true that the actual proportions going by one travel mode or another were different for different trip purposes: the proportion walking was especially high for the journey to school, and the proportion going by car was high for recreational travel, but with allowance for this the trends seem to have been similar. This can be proven where surveys have been taken (e.g. for the journey to school in 1970 and 1974), and is implied by the trends in public transport patronage per capita. That patronage continues downward make many people wonder whether public transport has any future.

The costs of speed and household budgets

Even though the popularisation of public transport was greatly assisted by falling fares, and motorisation was helped by the falling real prices of cars and petrol, the widespread
Switch to speedy transport was made possible chiefly by rising incomes. The steady rise in incomes in Australia over the past century meant that people increasingly had cash left over after paying for the basic necessities of life - expenses like food, clothing and a house to live in - and so were able to increase the proportion of their expenditure going to transport. The switch to more expensive means of travel was accompanied by an increase in the prominence of transport in consumer budgets.

Chart 1.9 Means of transport used on the journey to work, 1901-1976
SPEED AND COST

Statistically speaking, we know of only two reasonably firm points in this process of growth. The first was at the beginning of the process: when most people used only free transport, namely walking, the proportion of their budgets spent on transport was necessarily small. The second known point is towards the end: according to the Household Expenditure Surveys the percentage of household expenditure spent on transport by residents of the seven Australian capital cities was 15.5 in 1974-5 and 17.5 in 1975-6. These were higher proportions than those observed in the USA, Canada, West Germany or the United Kingdom (Morris and Wigan 1978). It has been suggested that the relatively modest Australian expenditure on home heating releases cash for cars.

Table 1.5 Percentage of household expenditure on travel for no-car and motorist households, various cities, c 1970.

<table>
<thead>
<tr>
<th></th>
<th>Carless households</th>
<th>Households with cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian capital cities 1974-5</td>
<td>4.5</td>
<td>15.5</td>
</tr>
<tr>
<td>United Kingdom 1972</td>
<td>4.0</td>
<td>17.0</td>
</tr>
<tr>
<td>Washington DC 1968</td>
<td>4.2</td>
<td>11.0</td>
</tr>
<tr>
<td>Twin cities 1970</td>
<td>3.4</td>
<td></td>
</tr>
</tbody>
</table>

Source: Zahavi 1979:322a, 324
ABS Household Expenditure Survey 1974-5

In countries with better historical records of household expenditures than Australia it is possible to describe the process of increasing transport expenditure in a little more detail. According to expenditure surveys made in the United Kingdom and Sweden over the past few decades the proportion of household expenditure devoted to transport in the days before mass motorisation was around half present-day figures (Morris and Wigan 1978:51-3). The same may have been true of the USA, where the earliest expenditure survey was taken in 1929, and showed the proportion of transport expenses in household budgets to be approximately 70 per cent of present day figures. (By this time in the USA motorisation was already well advanced.) The proposition that in the heyday of public transport fares absorbed about 7 per cent of total household expenditures can also be supported by rough calculations for Australia in the years just before the First World War, given the wage rates then prevailing and the level of public
transport patronage and fares.

If in the switch from public transport to motoring the proportion of household expenditure going to transport increases, the effect of the switch should be visible in a current comparison between carless households and those with cars. Table 1.5 confirms that this is the case: non-motorist households in Australian cities in the mid 1970s devoted less than 5 per cent of their total expenditure to transport, as against 15.5 per cent by motorist households. A similar differential applied also in the USA and the UK, and in these countries (and probably also in Australia, though the Australian surveys were not explicit on this point) the difference in expenditure patterns between car-owning and carless households did not vary with income. Households with cars spent much more on transport than those without, but spent less on public transport fares, so that 95 per cent of their transport spending was on motoring (Table 1.6).

The fact that the average transport expenditure of non-motorist households in today's largely motorised society is less than a fifth of that of motorists does not conflict with our historical evidence that the proportion of transport spending in household budgets merely doubled during the process of motorisation. The reason is that those households which today remain carless generally have low incomes, and a low demand for travel. Elderly people still quite often do without cars, not only because they cannot afford them, but because they have no desire to travel the distances that would justify running a car. Similarly young people living alone quite often do without a car. There is some evidence that young, single people have the alternative of renting a flat in a convenient location or buying a car and continuing to live at home. On the other hand, in Australia very few families consisting of a married couple with children do without at least one car, and multiple car ownership is common, particularly for those with higher incomes. It is the incidence of multiple car ownership which explains why motoring expenses do not vary much as a proportion of household income at different income levels, even though the cost of the standard motoring package remains constant as income increases (Table 1.6). The increase in the proportion of multiple car households has also contributed to keeping up the proportion of motoring expenditure in household budgets over the past two decades. If households had been content with one car each, then given the falling relative cost of the standard motoring package expenditure on transport would have declined once motorisation had been achieved.
### Table 1.6 Average household expenditure by car ownership, Australian capital cities 1974-1975

<table>
<thead>
<tr>
<th></th>
<th>Number of cars</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motoring expenditure per household ($/week)</strong></td>
<td></td>
<td>1.71</td>
<td>20.71</td>
<td>35.06</td>
<td>61.60</td>
<td>21.64</td>
</tr>
<tr>
<td>$/car/week</td>
<td>-</td>
<td>20.71</td>
<td>17.53</td>
<td>17.35</td>
<td>19.06</td>
<td></td>
</tr>
<tr>
<td>Rail fares ($/week)</td>
<td>.94</td>
<td>.57</td>
<td>.60</td>
<td>.80</td>
<td>.67</td>
<td></td>
</tr>
<tr>
<td>Tram, bus fares</td>
<td>1.40</td>
<td>.79</td>
<td>.64</td>
<td>.76</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td><strong>Transport expenditure</strong></td>
<td></td>
<td>4.05</td>
<td>22.07</td>
<td>36.30</td>
<td>63.16</td>
<td>23.19</td>
</tr>
<tr>
<td>% OF TOTAL EXPENDITURE</td>
<td></td>
<td>1.9</td>
<td>13.6</td>
<td>17.0</td>
<td>22.0</td>
<td>13.8</td>
</tr>
<tr>
<td>Motoring expenditure</td>
<td></td>
<td>2.6</td>
<td>20.71</td>
<td>35.06</td>
<td>61.60</td>
<td>21.64</td>
</tr>
<tr>
<td>Rail fares</td>
<td>1.0</td>
<td>.4</td>
<td>.3</td>
<td>.3</td>
<td>.4</td>
<td></td>
</tr>
<tr>
<td>Tram, bus fares</td>
<td>1.6</td>
<td>.5</td>
<td>.3</td>
<td>.3</td>
<td>.6</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>4.5</td>
<td>14.4</td>
<td>17.6</td>
<td>22.6</td>
<td>14.8</td>
</tr>
</tbody>
</table>

| Average household income ($/week) | 113 | 198 | 280 | 384 | 206 |
| Household income per adult ($/week) | 72 | 100 | 118 | 121 | 101 |
| Approximate weekly travel distance per head (km) | 70 | 170 | 200 | 300 | 170 |

Source: ABS Household Expenditure Survey

**Conclusion**

In the history of transport technology there have been two main occasions when speed has been increased: **first, the introduction of mechanised public transport and second, the mechanisation of private transport.** Mechanised public transport started with the railways, and did not reach the streets till late in the nineteenth century. Regular suburban train services were running in the main Australian cities at speeds approaching 30 kilometres an hour by the 1880s, while tram speeds of 15 kilometres an hour were usual in the early years of this century. These speeds have not improved much since. Similarly we may suspect that the speed of private cars has not increased much since they passed their experimental stage in the early 1920s. In one sense car speeds were no improvement over rail (both had an urban average vehicular speeds between 30 and 40 kilometres an hour), but for overall
journey times the car was faster since it greatly reduced walking and waiting and was not route bound.

In each case when these new technologies were introduced they were expensive relative to incomes. It took several decades for their price to come down relative to wages to the point where a majority of the population could use the new transport modes regularly, and even then it was necessary for people to increase the proportion of their incomes spent on transport in order to enjoy the benefits of speed. Yet surely they did not desire speed for its own sake. How then, did people use their increased speed of travel?

ENDNOTES

1. The Department of Main Roads based its estimates on the assumption that the average vehicle in the pre-war period travelled 20 miles for every gallon of petrol. This assumption cannot be proved, but seemed reasonable to the road engineers of the time. According to the Department's calculations as published in its 1934-5 Annual Report the average distance travelled by motor vehicles in New South Wales in 1929-30 was 12,000 kilometres, in 1930-31, 7,800 kilometres and in 1934-5 12,000 kilometres. These figures may be compared with more recent estimates from ABS Surveys of Motor Vehicle Usage: 1963, 13,500 kilometres, 1971, 16,000 kilometres and 1976, 15,400 kilometres.

2. The following figures for the average daily travel distance of cars by city derive from Zahavi (1979:152), and from Lawlor (1978:39) and the Sydney Area Transportation Study. Tel Aviv, Israel, 1965, 30 km; Bogota, Columbia, 1969, 31 km; Cincinnati, USA, 1965, 32 km; Sydney, Australia 1971, 33 km; Minneapolis/St Paul, USA, 1970, 34 km; Washington DC, USA, 1968, 35 km; Melbourne, Australia 1975, 35 km and Kuala Lumpur, Malaysia, 1973, 36 km.

3. According to the Cumberland County Council (1948:153) 22 per cent of vehicular trips in Sydney in 1946-7 were by train, 3 per cent by ferry, 46 per cent by tram and 16 per cent by bus, to give a public transport total of 87 per cent as against a private car proportion of 13 per cent. In 1971 (SATS 1974:vol 1:VI-4) the proportions were: train 11 per cent, ferry 1 per cent, bus 16 per cent, a public transport total of 28 per cent as against 72 per cent by private car. The proportion by car continued to increase during the 1970s.
Travel distance

When people change from slower to faster transport they can use it to travel further in the same time, either by making more trips or by lengthening individual trips so as to take in new and further destinations. Alternatively they may use it to cover the same distance in less time. In the nineteenth century it was assumed that faster transport generally meant longer trips, and investment in new transport facilities was justified on the grounds that it enabled people to travel further. This argument was particularly prominent when new suburban railways were being built. However, more recently the justification of roadbuilding schemes has been given largely in terms of time savings: people would be able to make their existing journeys more quickly. Which of these two arguments is correct can only be found by empirical investigation. Accordingly in this chapter we will consider how people used the two main increases in speed; first the increase from walking to public transport, and second the increase from public transport to motoring. Did they travel further or did they save time?

The change from walking to public transport

Up to the middle of the nineteenth century walking was the main means of passenger transport in the then-small Australian cities, except that a minority of the wealthy could afford to ride horses or travel by horse-drawn carriage. Gradually trains, horse buses and trams were introduced, but it was not until the early twentieth century that most citizens were able to afford public transport for their regular daily trips. Only after the electrification of the tramways did a majority of workers adopt mechanical transport for their journeys to work. In Edwardian times public transport was also widely used for sporting, beach and hill excursions and for shopping expeditions into the city centre, but local shopping, local visiting and school journeys were still mainly accomplished on foot.
Unfortunately there is very little information on walking distances in Australian cities prior to the first introduction of public transport. However, they were probably not unduly long, both because of the small size of the cities in those days and because people would have arranged their affairs to avoid having to walk too far. This was certainly the case for the only pre-public transport city for which figures are readily available. In the 1950s a survey was conducted in Agra, the Indian city which is the site of the Taj Mahal (Chauhan 1966:185). At that time the city was a compact but populous urban area in which the main means of transport was walking with some subsidiary use of bicycles. Journeys to work were short; they averaged about 1.2 kilometres and 90 per cent were less than 3 kilometres. Even when people had no option but to walk, few walked very far. Further, the compactness of the city was probably due in large degree to the need to minimise walking distances.

More detailed information is available for a number of cities in which some of the population could afford public transport, while others could not. To take another Indian example, Madras in 1961 was a sprawling urban area with a well-developed bus service whose fares were too high for the poor majority of the people to use buses regularly. Among the poor slum dwellers who had regular workplaces walking was by far the most common means of getting to work (Census of India 1961:IX-XI-C:T.48). Three quarters of them walked, 20 per cent took public transport, and a few cycled. Public transport and cycling were popular for the longer trips, but even where the journey was 5 kilometres long (an hour's walk) riders were in a bare majority over pedestrians, and at 10 kilometres (two hour's walk each way daily) there were still people who walked, presumably because they could not afford to ride. However, such heroic long-distance walkers were a small minority and the average walking distance was a little under two kilometres, which would put it as less than half an hour. Even so, this was greater than in Agra, and suggests that when the wealthy citizens of a city adopt faster transport some of their poor neighbours attempt to perform the same journeys more cheaply and slowly, at great time cost. On the other hand, most of those who could not afford bus fares opted for the appalling living conditions of the inner city slums rather than spend hours daily walking to and from a hut in the less congested outer areas.

There is a certain amount of anecdotal evidence about walking distances in Australian cities at a similar stage in their development - that is, when some citizens could afford
faster transport and some could not. In the 1880s North Adelaide scarcely merited a horse bus service from the city because it was within walking distance, which implies that people did not baulk at walks of up to three kilometres (Radcliffe and Steele 1974:9). In 1891, at the end of the land boom, it was claimed by a councillor of the Melbourne working class suburb of Collingwood that many artisans living in his municipality walked to work daily in the city (Davison 1978:151). Their journeys would have averaged between 3 and 4 kilometres, taking about 3/4 hour each way. However, the average walk to work of Collingwood residents would have been much shorter since many worked locally. Again, at the turn of the century a walk of 5.5 kilometres, taking an hour, was regarded as rather long in Ballarat. The relevant anecdote was told by Mr H P James, who sought a job from the Superintendent of the Ballarat horse tramways in 1905. 'Mr Smith held a pen and began to write ... my address. When I told him ... he said "Whew" because Scott Parade near Russell Square was a fair distance away ... At nine o'clock on this Sunday night I sallied forth on my trek to the tram sheds. You may ask "Why not take a tram!" Ha, here's the rub, for at this time there were no concession fares nor passes for employees ... and at the rates operating it would have taken almost all my night's earnings to travel by tram' (James 1975:4). Not long after this the Ballarat tramways were electrified, the fares came down, and Mr James was able to ride. Given that anecdotal evidence tends to remark on the unusual rather than the typical there is nothing here to indicate that average walking distances in Australian cities in the late nineteenth century were any further than among the slum dwellers of Madras in 1961. This being the case only a minority of workers spent more than half an hour walking to work.

After the fare reductions of the early years of this century most workers could afford to travel to work by tram or train. This gave them the opportunity to adopt faster transport, but did not relieve them of the necessity to walk. For many shorter journeys it was still quicker to walk all the way rather than to walk to the tram stop or railway station, wait there, take the tram or train and then walk again at the further end of the trip. In Edwardian times the break-even distances where a tram was generally faster than walking all the way was perhaps around 2 kilometres (24 minutes) depending very much on whether there happened to be a tram route going in the desired direction. Because of the wider spacing of railway stations and the longer walks involved the break-even distance
for train journeys was further: 2.5 kilometres (30 minutes). If the evidence on walking distances already given is to be trusted, in the days before public transport was introduced few regular walks took more time than this, and therefore not many pedestrians could save time by switching to public transport. However, those who were willing to extend their journey duration somewhat could receive rewards in terms of considerably increased journey distances. We would therefore expect that walking distances would diminish a little, due to the conversion of a few longer walks to public transport, while the average tram or train journey would be longer than the average walked both in distance and duration.

The Australian evidence on walking distance during the period after public transport became universally available but before motor cars had become a serious competitor for it is still mainly anecdotal. Stories are told of long, atypical walks. Archbishop Mannix of Melbourne became notorious for his daily walk of 5 kilometres from his palace to his cathedral. During the depression of the 1930s many coal miners in Newcastle, NSW, having lost their jobs when the local colliery closed, substituted long daily walks to pits that were still open. When the Sydney Harbour Bridge opened in 1932 it carried substantial pedestrian traffic, presumably not all sightseers, and since the bridge itself was over a kilometre long the trips involved must have averaged 2 or 3 kilometres (DMR Reports 1933 et seq).

International evidence on walking distances in cities with cheap public transport but few private cars has nowadays to be drawn mainly from Eastern Europe (Szalai 1972). In some Eastern European cities bicycles were popular, but in other hillier cities people made a straight choice between walking and public transport. In the non-bicycle cities people generally walked to work if their journeys were less than 2 kilometres, resulting in average walking distances on the journey to work of around a kilometre. These observations correlate with typical walks to work of up 25 minutes recorded for London factory girls in the 1930s (Liepmann 1944:169). On the other hand, in the bicycle cities and also in Lima, Peru, people seemed inclined to ride even for journeys as short as 1 kilometre. The use of bicycles for middle-distance trips of between 1 and 5 kilometres in preference to walking (which was common for very short trips) and public transport (common for long journeys) was also noted among university students in that bicycle-conscious city, Christchurch, New Zealand, as recently as 1966 (Williman 1974).

These statistics do not pretend to any great accuracy, but
as far as they go they confirm the opinion voiced by several Australian tramway managers in Edwardian times that people making trips of 3 kilometres or more travelled by tram provided there was one available (RCTFR 1911:liii). The only market potential for converting pedestrians to tram travellers lay in short journeys of around a mile, where penny section fares and frequent services might still persuade some of the remaining footsloggers to give up and ride.

Tram journeys in Sydney and Melbourne in Edwardian times seem to have averaged about 3 kilometres, not much further than a man could easily walk - and not much faster either, since at the speeds then current such journeys would have taken about 26 minutes (say 12 minutes' tram ride and 14 minutes walking and waiting) as against 36 minutes walking all the way. In Adelaide and Brisbane the average tram ride seems to have been a little shorter, and hence even closer to walking distance (RCTFR 1911:xcvi). This may have been an effect of city size, but against this the average journey in Hobart was equal to that in Sydney or Melbourne. Contemporaries attributed this to the high fares charged by the Hobart Electric Tramway Company. Some of these tram rides would have replaced walked trips with no change of origin or destination and some time savings, but most were longer than people had previously walked.

Train journeys, by contrast, were already long. The average length of a train ride in Edwardian Melbourne was 8 kilometres, and 11 kilometres in Sydney (VR and NSWR Reports). Three quarters of an hour would have been a typical journey duration, composed of 20 to 25 minutes actual riding and 20 to 25 minutes walking to and from stations and waiting for the train. Judging by the sale of worker's weekly and other periodical tickets, even at this early date nearly half of all suburban rail journeys would have been made by people travelling to work. This, then, is the origin of the long-duration work journey. It was a response to the high train speeds of the suburban railways, which meant that long distances could be covered quickly once the traveller had spent the necessary time to walk to and from the stations. The benefit of these long duration journeys was that people were able to increase their distances travelled considerably. At some cash cost and at the price of an extra 20 minutes travelling each way, a journey could be increased from 2 to 8 kilometres; in other words, the family could move to the then outer suburbs. The benefit of this move, according to the real estate agents of the day, was that people could live in much better houses with bigger backyards.
The impact of motoring

As shown in Chapter 1, from the traveller's point of view the main disadvantage of motoring was its high cash costs. However in the post-war period this disadvantage became less significant, till by the 1970s a high proportion of the adult residents of Australian cities could afford car travel. This gave them a three way choice: walking, public transport or motoring. The public response to the cheapening of motoring was a great increase in the extent to which people made use of it. By 1971 on weekdays Sydney residents were making about 1.5 car trips a day each (up from near zero during the war) while public transport patronage had fallen from 1.5 trips per person per day to 0.5 (SATS 1974). Walking continued as a minority means of transport. In the middle suburbs of Adelaide the average schoolchild made two trips a day on foot and the average adult less than one (Braddock and Dixon 1978). In the big cities walking catered for about 7 per cent of all journeys to work, half of all journeys to school and an intermediate proportion of trips for other purposes (ABS:JTW 1974; SATS 1974). Public transport carried about a third of the work and school trips (proportions which were rapidly declining) and a lesser proportion of trips for shopping and recreation.

The changeover from walking and public transport to motoring has thus been extensively documented. But what was the effect of the change in terms of distances covered, and times spent travelling? We will tackle this question in three parts: first, the effect of the introduction of motoring on distances walked; second, its effect on distances travelled by public transport, and finally the question as to whether motoring trips were longer than the public transport journeys and walks they replaced.

The introduction of motoring meant that walking now had two competitors, both faster. In response the proportion of trips walked continued to decline gently. This may have been due to reductions in walking distance, with the transfer of longer walks to the car, but may also have been due to the replacement of walked trips by longer car trips. The evidence is that the second of these explanations was by far the most important. Even in the motorised cities of the 1970s, including those of Australia, walking was the majority choice as a means of transport to work for distances up to a kilometre, taking about 12 minutes (Szalai 1972, ABS:JTW 1974) but beyond this distance the popularity of walking diminished rapidly and very few walks to work took longer than half an hour. In the public transport era walks of more than half an hour were perhaps a little more common than now, and some reduction in the willingness to walk
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long distances can therefore be detected. However, the reduction in the proportion of trips made on foot came about chiefly because motoring, like public transport, encouraged people to make trips that were too long to walk all the way.

A fair amount of information is available on walking distances in motorised cities for journey purposes other than work. For example, the average length of all walks to school (including university) in Australia was around a kilometre in 1974 (ABS:JTW 1974). If one can judge by the situation in Melbourne, walks to suburban universities were close to this average but those to inner urban universities were longer, perhaps because of the difficulty of motoring in the inner suburbs (Ogden 1973). In the highly motorised north-eastern suburbs of Adelaide in 1977 the average length of a walk to high school was a little over a kilometre, while the average walk to primary school was 700 metres (Braddock and Dixon 1978). This difference reflected not only the wider distribution of primary schools but the greater inclination of parents to drive young children to school.

Only a few surveys have tried to observe the distances people walk to go shopping. In Sydney the average duration for a shopping trip on foot was given as 14 minutes (SATS 1974), the same as any other kind of walked journey, but in north east Adelaide shopping trips were shorter than most, perhaps because of the inconvenience of carrying parcels (Braddock and Dixon 1978).

Recreational walking has also been little surveyed. In London in the mid 1960s the number of adults who reported going for a walk of a mile or more at least once a month was about equal to the number who went on drives for pleasure - two-thirds of the total in each case (Young and Willmott 1975:216). Walking was particularly popular among clerks, presumably to offset their sedentary occupation. Retired men also tended to walk more than others, perhaps because they had the time and this was a cheap and pleasant way of using it, and perhaps also because they belonged to a generation which had grown up without motor cars and were therefore used to walking (UK Social Trends). This certainly seemed to be the case in the USA, where in the 1960s elderly people walked more than their middle-aged children (Paaswell and Edelstein 1976). The evidence of time-budget studies suggested that walking was a major recreation among American men in the 1930s, a recreation which gave way over the next few decades to watching TV and driving cars for pleasure (Scitovsky 1976:163). In north east Adelaide elderly people also walked more than young adults, though children walked most of all. The frequency of
recreational walking depended on the attractiveness of the local streets and parks, but the distance walked was generally short - 600 metres would be typical (Braddock and Dixon 1978).

It is very hard to say whether these present-day walking distances for non-work trips are much less than they were when people had only the alternative of public transport, or when they had no alternative at all. However present-day walking distances, and present-day walk trip durations, do not vary much by trip purpose. At around 14 minutes the average walk trip duration is less than for any other means of travel, reflecting the ready availability of mechanised transport. Even so walking remains indispensable for it is both faster and cheaper than the car for short distances.

So far as can be calculated from average revenue and the fare table, average tram/bus journey lengths increased slowly in Melbourne and Sydney from Edwardian times until the Second World War, when they stabilised at around 4 kilometres. The increase in Brisbane and Hobart seems to have been a little greater, to around 5 kilometres, but this may be an illusion created by unreliable statistics (Wilbur Smith 1965a, 1965b). In all the larger cities the average tram/bus journey lasted about 30 minutes door to door. The duration of an average bus ride in the 1970s was similar to that of an average tram journey 60 years earlier, for the slow increase in distances had taken advantage of the rise in average speeds chronicled in Chapter 1. Motorisation, therefore, seems to have had little effect on average journey distances by tram and bus, neither causing them to fall (as would happen if the longer tram/bus trips were replaced by faster transport) nor causing them to rise (as would happen if tram/bus patrons tried to emulate motoring distances).

In both Sydney and Melbourne the average rail journey in 1971 was longer than it had been at the beginning of the century, the increase in Melbourne being more than a doubling (from 7 to 15 kilometres) and in Sydney relatively modest (from about 10 kilometres to 15.5). Assuming that something like the present rail walk/wait times applied in the past, and taking train speeds from the timetables in force, it may be estimated that in Melbourne the doubling of average distance was achieved at an increase in average duration of only 10 per cent. In part this was due to the speeding up of trains at electrification, but much of the disparity was due to the nature of the distance/duration relationship: with such a high proportion of total journey time devoted to walking and waiting, a considerable increase in distance could be accomplished at a relatively modest increase in time.
The increase in journey lengths by train during the years of motorisation reflected the importance of the suburban railways in serving traffic to and from the central business district. Because of traffic congestion the railways retained much of their competitive advantage in this specialised traffic, and as cities grew in size the average length of train trips to the city centre increased. At the same time the railways lost much of their competitive advantage with respect to intra-suburban trips, where the car could achieve similar line-haul speeds but without the walk/wait times. Accordingly the railways lost some of their short-distance traffic. The rise in train journey distances was therefore partly due to the increase in city size, and partly due to motorisation.

The main question, however, is not what happened to walking distance or to the length of public transport trips as a result of the switch to motoring, but whether the motor trips were longer than the public transport or walking trips they replaced. On this hinges the answer to the question as to whether the main benefit of the change was an increase in trip distances or savings in time. Unfortunately, it is difficult to obtain an answer, since it is only recently that statistics have been collected on the length of motoring trips.

An exception to the general lack of statistical sources is a survey conducted in 1926 which makes possible a rough estimate of the average distance travelled by vehicles entering the City of Melbourne in that year (MTPC 1929:42). For passenger motor cars this was about 5 or 6 kilometres, rather less than the average length of public transport journeys to the same destination. If anything the motor car replaced public transport for the shorter journeys; it was more competitive with the slow trams and buses than with the relatively fast suburban trains. However, the survey says nothing about the effect of motor cars on travel outside the city centre.

In the 1930s the New South Wales Department of Main Roads estimated that an average motor car in that state in 1929–30 and again in 1934–5 travelled about 12,000 kilometres a year (DMR Report 1934–5). At this time public transport travel in Sydney amounted to less than 3000 kilometres per person per annum (Table 2.1). Thus if an average public transport traveller bought a car he was likely to increase his total travel distance several times over, and in all probability that of the other members of his family as well. However, it is possible that only people whose travel distances were already high would have bought cars, in which case their increase in distance travelled would not have been so great. Certainly many regular travellers on the Sydney suburban railways in the
1920s would have covered more than 12,000 kilometres a year by train; they need only have had a regular journey to work slightly more than average rail commuter length to accomplish this (NSWR Report 1929-30). However, the opinion of contemporaries was that cars were used more for excursions and long-distance travel than for regular daily journeys (Davies 1978). If this were the case the new motor cars did not replace the regular journey to work carried out by rail, so much as the occasional train excursions and social and recreational outings hitherto carried out within the neighbourhood on foot or by tram. Car purchase was therefore almost certainly followed by a considerable increase in distance travelled. This travel was accomplished at a much greater speed than hitherto, so it is not possible to say whether the total time the typical car-buyer devoted to travel went up or down.

The Department of Main Roads' estimates of annual car mileage can be combined with data on car ownership and an estimate of car occupancy (a little higher than now) to provide an approximate figure for passenger kilometres travelled by car in Sydney in 1934 (Table 2.1). This figure can then be compared with estimates of total public transport travel derived from the public transport operators' reports. At this time Sydney residents were travelling about the same average annual distance on public transport as they had 20 years earlier - the difference being that the number of trips per head had fallen a little (Chart 1.2) compensated by a rise in average distance per trip. No estimates are possible for travel by private vehicle in Sydney in 1914, but it would not have amounted to much since most of the private vehicles then were horse-drawn. However, by 1934 private cars were already responsible for about a third of all vehicular passenger-kilometres in Sydney. Once again we see that partial motorisation was responsible for an increase in travel distances, though we can say very little about travel times.

During the Second World War car usage was restricted by petrol rationing but the upsurge in public traffic was so strong that passenger kilometres per capita increased.

The post-war decline of public transport affected the trams and buses much more than the railways. Passenger kilometres by on-street public transport fell by nearly half in the three decades after the war, and passenger kilometres by the trains and ferries by about 10 per cent (Table 2.1). Motoring was substituted for the shorter-distance public transport trips (those by tram and bus) but distances were increased in the process. Travel kilometres per citizen nearly doubled over the
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30 years, and motorisation was therefore associated with a substantial rise in distances travelled. Some of the extra distance would have come from entirely new trips hitherto made by public transport or on foot. A trip to the corner store would be replaced by one to the neighbourhood shopping centre, and so on. However, for lack of information on trip duration and on walking we do not know whether these changes required people to spend more or less time travelling. The probability is that there were time savings as well as gains in distance—a proposition that is now considered in more detail for the journey to work.

Table 2.1 Annual vehicular travel within the Sydney Urban Area

<table>
<thead>
<tr>
<th>Year</th>
<th>Tram/bus</th>
<th>Train/ferry</th>
<th>Total public transport</th>
<th>Car</th>
<th>Public transport</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>850</td>
<td>780</td>
<td>1630</td>
<td>n.a.</td>
<td>2600</td>
<td>n.a.</td>
</tr>
<tr>
<td>1934</td>
<td>1420</td>
<td>1530</td>
<td>2950</td>
<td>1400</td>
<td>2600</td>
<td>3700</td>
</tr>
<tr>
<td>1945</td>
<td>2300</td>
<td>3230</td>
<td>5530</td>
<td>770</td>
<td>4000</td>
<td>4500</td>
</tr>
<tr>
<td>1954</td>
<td>1561</td>
<td>3530</td>
<td>5090</td>
<td>n.a.</td>
<td>3100</td>
<td>n.a.</td>
</tr>
<tr>
<td>1974</td>
<td>1190</td>
<td>2960</td>
<td>4160</td>
<td>17900</td>
<td>1650</td>
<td>8800</td>
</tr>
</tbody>
</table>

n.a. No estimate possible.

Source: Public transport figures derived from the reports of the relevant authorities. Road estimates based on DMR Report 1934-5, CCC (1948) and Lawlor (1978), using car registration figures from the NSW Year Books on the assumption that car ownership per capita was equal in Sydney and the rest of NSW.

The length of work trips

Though work journeys comprised only a third of all trips made in the big Australian cities in 1971, their importance for the transport system was greater than this would indicate. Because of their generally greater length they accounted for approximately half of all passenger-kilometres travelled, and because they were mostly carried out during the two daily peak periods they determined the peak demand for urban transport, and hence the investments made in transport capacity (Manning 1978:137).
According to the estimates presented on Charts 2.1 and 2.2, the average length of journeys to work by train and car drifted upwards fairly steadily in both Sydney and Melbourne from 1901 to 1971, while the average distance by tram/bus and cycle remained the same and that by walking fell. Apart from the uncertain position of private horse-drawn transport before the
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First World War, the relative length of journeys by the different modes remained constant, with train journeys the longest, followed by car, tram/bus, cycle and walking. The average length of work journeys as a whole reflected both the upward drift of journey length by car and train, and the switch away from short distance modes (walking, cycling, buses and trams) to those where journey length was longer and increasing. Only one change ran contra to this general trend, this being the decline in the relative importance of the longest-distance mode of all (trains) in favour of motor cars after 1950. This was the period when the railways were losing their intra-suburban traffic and being left as specialists in city centre commutes.

Mainly because of the change from modes of transport where journey distance was low and steady to those where it was high and rising the overall average drifted upwards from between 3 and 4 kilometres in both Sydney and Melbourne at Federation to between 10 and 11 in both in 1971. If the figures are to be believed Melbourne lagged a little, particularly in the 1930s, but the data are too rough to be certain. Yet despite all the uncertainty the evidence for a rise of between three and four times in average journey distance between 1901 and 1971 is reasonably good. Average journey length in 1901 cannot have been much more than 4 kilometres, since this would have implied work trip lengths by train and tram impossibly above the average length of all trips by those modes and would also have implied that walks of 3 kilometres (Collingwood to central Melbourne) were common rather than the upper limit. On the other hand, an overall average much below 3 kilometres would have implied that walks to work averaged only 1 kilometre as now, which is again contrary to the anecdotal evidence. The estimates of 10 or 11 kilometres in 1971 are again reasonably certain, being based on census and transportation study evidence.

According to the estimates incorporated on Chart 2.2 these increases in journey distance were accomplished without much change in travel times. Journey duration by train drifted upwards, with a pause due to speeding up at electrification, and the time taken by car trips also probably increased, though the dramatic increase shown for Melbourne from 20 minutes in 1964 to 27 in 1970 was perhaps due to the deficiencies of the statistical surveys. Even so, the relative duration of journeys by each mode seems, like the relative distance, to have remained constant, though in a different rank order. Train journeys, longest in distance, were also longest in time, while pedestrian journeys were the shortest by both measures.
but the relative position of car and tram/bus was reversed, with the latter shorter in distance but longer in duration.

Chart 2.2 The average duration of work journeys 1901-1971

Minutes

2.2a Sydney

2.2b Melbourne

Sources: see Chart 2.1

As with average distance, the average duration of all journeys represents a weighted average of durations by mode. The overall average in Melbourne by these calculations was always a little less than in Sydney, partly reflecting shorter distances and partly greater speed. In both cities the overall average seems to have remained within a narrow range, deviating no more than three minutes each side of half an hour in the
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case of Melbourne. This is particularly impressive when one remembers the changes in transport technology, in city size and in journey length. Even so, the switch from walking to public transport early this century was perhaps accompanied by an increase in average journey times, while according to the estimates the change from public transport to motoring after 1945 resulted in a reduction in average duration in Sydney at least. Despite this, the figures imply that most of the workers who switched from walking, cycling and bus/tram transport to motoring in the post-war period took the opportunity to travel further. Over the whole period of seven decades an increase in average journey distance of the order of three or four times was accomplished with very little change in average duration.

Comparisons with other cities

The near constancy of duration of the average journey to work in Sydney and Melbourne is consonant with the results of the time budget studies conducted in various Australian and overseas cities in the 1960s and 1970s. A time budget study shows, on average, how people distributed the 24 hours of their day among various activities including travel. The studies demonstrated that the duration of the journey to work tended to be less in motorised than in non-motorised cities, but that it tended to be longer in large cities than in small. Predicting change over time on the basis of these observations of different places at the same time, we can see conflicting tendencies in cities which have both grown and adopted motor transport, and would thus expect journey duration to be approximately constant.

The effect of motorisation is shown in Table 2.2. The table distinguishes three adult population groups, because their travel behaviour has been shown to be consistently different. Employed men spend much more time on transport than housewives, entirely because of the long duration of their journeys to work, while employed women generally economise on travel time compared with the men, but spend much more time travelling than women who work at home. The table shows no significant difference between the time devoted to non-work travel in motorised and public transport cities, but points to a reduction in work journey duration with motorisation. Comparing the two groups of cities in the table, a reduction in journey duration of about 25 per cent was more than counterbalanced by greater speed of travel, such that workers in the motorised cities travelled twice the distance on their work journeys as workers in the public transport cities. The
commentary on the time-budget studies pointed out:

By far the most intriguing aspect of the trip to work cross-nationally is the relative constancy in the average time allocated to this purpose across our sites in the face of the most complete variation in commuting technology. There seems to be a distinct preference towards using increased efficiency in transport to spread out in space, and modal distances to the workplace across our sites vary by a factor of fifteen or more, while time allocations remain in the average within an impressively narrow range. (Szalai 1972:123).

Table 2.2 Average travel time budgets by population minutes per day, group and car ownership.
Sixteen cities, ca. 1970

<table>
<thead>
<tr>
<th>Car ownership</th>
<th>Employed men</th>
<th>Employed women</th>
<th>Housewives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>work travel</td>
<td>work travel</td>
<td>work travel</td>
</tr>
<tr>
<td>weekdays low</td>
<td>60</td>
<td>48</td>
<td>30</td>
</tr>
<tr>
<td>high</td>
<td>46</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>weekends low</td>
<td>-</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>high</td>
<td>-</td>
<td>77</td>
<td>-</td>
</tr>
</tbody>
</table>

This table covers 9 cities with low car ownership (less than 33 per cent of all families had cars) and 7 cities with high car ownership.

Source: Szalai (1972); Cities Commission (1975).

As Sydney and Melbourne switched from motoring to public transport we would therefore have expected some time saving accompanied by considerable increases in distance. We have observed the increases in distance but have found evidence of time savings only for Sydney. The lack of time savings was perhaps associated with the fact that both cities grew considerably in population as motorisation proceeded.

Not surprisingly, people who live in small cities spend less time travelling than those who live in large cities (Table 2.3). This was true for all three population groups, and for both work and non-work travel on weekdays and at weekends. The rate of increase in the duration of the journey to work with increasing city size was, however, quite gentle. The average
time spent on work travel by employed men in Melbourne in 1974 was 60 minutes a day, as against 35 minutes by their counterparts in Albury/Wodonga. A difference of 64 times in population was thus accompanied by a difference of only 1.7 times in the average duration of the journey to work. At this rate it would require substantial growth in population to generate a noticeable increase in work journey duration (Gunn 1979:76). The growth of Sydney and Melbourne over the past century was of the order of 11-15 times, and this might have generated an increase in average work journey duration had not the cities adopted faster transport.

Table 2.3 Average travel time budgets by population and city size minutes per day, Fourteen cities, ca. 1970

<table>
<thead>
<tr>
<th>City size</th>
<th>Employed men work travel</th>
<th>Employed women work travel</th>
<th>Housewives work travel</th>
</tr>
</thead>
<tbody>
<tr>
<td>weekdays</td>
<td>small 53 36 41 30 38</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>large 57 41 47 32 49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekends</td>
<td>small  - 81 - 53 46</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>large  - 78 - 70 55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This table covers 8 cities with under 100,000 population and 6 cities with over 100,000 population.

Source: Szalai (1972); Cities Commission (1975).

The finding that the average duration of work journeys has been close to constant in Sydney and Melbourne, while the average distance covered has increased, is thus corroborated by a comparison between public transport cities and motorised cities, and between small and large cities. The cross-city comparisons also incline us to believe that travel time budgets for other trip purposes have remained constant, the benefit of speed being increased distance covered. Yet what benefit is this? Surely people do not wish to notch up kilometres for their own sake? To track down the true benefits of speed we need to investigate further, and indeed will do so in Chapter 3. However before proceeding we have to settle what seems to be a serious conflict between our finding that the benefit of speed is increased travel distance and the belief commonly held in the 1970s that the benefits of speed were best assessed in

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terms of time savings.

The time savings approach

Though the first Australian mention of time savings as a major benefit of faster transport occurred in justification of the Sydney underground railway (Manning 1983:Ch 2), the claim that the benefits of speed can be evaluated as time savings was much elaborated during the post-war period by the road construction authorities. For roadmakers the claim came as a natural development. In their unsophisticated days they had taken the relief of traffic congestion as their main investment criterion (Manning 1983:Ch 6) but with the rise of cost-benefit analysis it was no longer enough to claim that if the proposed roadworks were done the traffic would move faster; a case had to be made by analogy with private investment. To do this it was necessary to put a value on the benefits that the public received from the new road, in the sense of what they would be willing to pay for it had it been possible to charge a price for its use. In the case of commercial traffic the time savings achieved by travelling faster had an obvious value to the fleet operator, in that a vehicle travelling faster could make more trips per day. The first attempts to value time were restricted to the drivers of commercial vehicles, but soon valuation was extended to non-commercial travellers. The method was to study a group of people who had the choice of fast, expensive and slow, cheap transport for a given journey. Those for whom the time advantage was small, and its additional cost great, would generally travel slowly, while those for whom the time advantage was large and its extra cost relatively small would generally choose the faster means of transport. From these choices, and given a large enough sample, an average value of travel time savings could be estimated. Since this average value resulted from people's choices, it was claimed to be equivalent to the price they would be willing to pay to save time. Investments which increased the speed of private transport would be justified if the present value of the flow of time savings exceeded the present value of the costs of generating these savings.

Most investigators took their analysis at least one stage further, and noted that the value of travel time savings thus calculated for people on the journey to work was correlated with the traveller's wage rate (Stopher 1976). Generally speaking (and these results were subject to sampling error and, in the early days, errors of specification) travel time saved seemed to be worth between 25 and 50 per cent of the wage rate—an unexpectedly low percentage, but still one which led to
substantial values being put upon the benefits from many urban freeway projects. However in practical applications this correlation of the value of time savings with the wage rate was often disregarded. Its implication that roadworks which saved the time of the highly paid should have priority was not politically palatable. Again, cost-benefit analysis works by analogy with the investment appraisals of private business, and it was not obvious that the full value of the saved time, including consumer's surplus, should enter into cost-benefit analysis when it did not fully enter into the investment appraisals of a private business. In many cost-benefit studies, therefore, a value of time was adopted which was in effect an estimate of the flat-rate toll which could be levied on the traffic likely to use the new road.

Some investigators of the value of time made yet further claims. In econometric work on the choices of people whose travel alternatives involved different proportions of walking, waiting and in-vehicle time, they found that the highest correlation coefficients were achieved when savings of one kind of time and another were differently valued. Thus a minute spent walking or waiting seemed to be worse than a minute spent in a vehicle, while a minute in a motor car or train seemed generally preferable to a minute in a bus (Quarmby 1967). Such assessments were used to argue against public transport which required a change of vehicle rather than going all the way in the same bus, but otherwise had little practical effect.

Despite their reasonable unanimity over the value of travel time savings for people bound to and from work (if not over the precise weights to be given to savings of walking, waiting and in-vehicle time) the studies of the value of travel time had obvious limitations. One was that they concentrated on the journey to work: time might be worth something else for other sorts of travel. A second limitation was that statistically significant results could only be generated when the journeys involved were of fairly long duration — say 40 to 80 minutes. This in effect restricted the studies to the choices of people living in the middle and outer suburbs with the option of train or car travel to their jobs in the central business district. They thus omitted people who had chosen to save travel time, not by paying for fast transport, but by deliberately limiting themselves to short-distance, short-duration journeys. Further, and most serious, by restricting themselves to observing the transport choices of people making a particular trip at a particular time, the studies were so set up that they could not observe the adoption of faster transport in order to travel further. They cannot therefore be used to argue against
our finding that the chief benefit of speed is longer travel distance.

Even so, within their limitations the studies were carefully and competently done, and there is no need to quarrel with their finding that where people are committed to a long-distance journey to work and have the choice of fast, expensive and slow, cheap transport, those who can afford to do so will pay to have their work journeys speeded up. This insight can be used to give a more complete behavioural account of how people are likely to react to the introduction of faster transport.

The choice of journey duration and distance

The insights of the time savings approach can be reconciled with the finding that the main benefit of speed is longer journey distance if we assume that the willingness to spend time travelling on regular daily trips diminishes as journey duration rises. People will only undertake long-duration trips if it is not possible for them to abbreviate the trip, either by switching to faster transport or by rearranging their daily activities so that the long trip is no longer necessary. In other words, long journeys to work or to school (or for any other purpose) will be undertaken by the fastest means of transport that the traveller can afford, and even then will only be undertaken if the traveller is unable to find a more convenient job, or a more convenient school; or is unable to shift house to a more convenient location. Conversely, if a person's travelling times are not excessive and the opportunity for a better job (better school, better house...) arises which does not unduly extend them, that opportunity is likely to be taken.

In these circumstances the initial response to faster transport may be to save time, but with faster transport will come the realisation that opportunities which were previously inaccessible are now within range. Distant beaches seem closer, distant workplaces become possible employers, and distant houses possible places to live. As the tripmaker takes advantage of these opportunities, travel distances will increase, and time savings disappear or at least diminish.

Though it will generally be the case that the adoption of faster transport will result in greater journey distances, changing from one means of transport to another may still be accompanied by changes in the duration of the typical trip. In particular, it is likely that trips by public transport will take longer than those on foot, by cycle or by car. The reason is that public transport has a high marginal speed relative to
its average speed. Given the typical vehicular speeds and walk/wait times reported in Chapter 1, a Sydney train traveller who increases his journey duration from 40 to 60 minutes multiplies his distance covered by 3.5 times, whereas a motorist increases his by 1.6 times and a pedestrian by 1.5. Such a considerable increase in distance is likely to overcome the unwillingness to increase journey duration, and people who switch from walking to public transport are likely to spend more time travelling, while those who graduate from public transport to motoring are likely to save time as well as increase journey distance. Some evidence that this is what happens has been given in our comparison of travel time budgets in different cities.

The high marginal speeds of public transport also provide an explanation for the paradox that people seem quite willing to walk when journey distances are short, but are reported by the value of time studies as resenting the walked component of public transport and motoring trips. The explanation is that the journeys included in the value of time studies are already too long from the traveller's point of view, and there is a natural tendency to visit this resentment of the slowest leg of the total journey. The high value of walking time saved thus does not mean that people dislike walking, but that they dislike excessively long duration journeys.

Evidence for the hypothesis that the willingness to spend time travelling diminishes as trip duration increases, and that up to a point travel time is of little concern, may best be sought from descriptions of work travel, since the journey to work tends to be longer than other regular daily trips.

Satisfactory trip duration

Time spent at work dominates the worker's weekday schedule. Work travel extends the working day in both directions, and the day's other activities have to be fitted in before or (mostly) after. Work travel is not optional as to frequency, and the distance to be covered can only be changed if people shift their house or job. Though in some occupations (e.g. the building trades) the location of employment changes frequently, for most people it remains fixed for years at a time, and similarly home owners and even tenants tend to stay put. Sometimes workers have opportunities to change the time of day at which they travel: they may have a choice of shifts, or may be able to work overtime or flexitime, but for a majority the hours of signing on and signing off are fixed. Theoretically they can alter journey duration by changing modes of travel, but even here the evidence is that people are creatures of
habit and that decisions are only occasionally reviewed. In all these respects work travel contrasts with travel for shopping or social and recreational purposes, for the frequency of these kinds of journey can generally be altered, as can the destination and the amount of time spent there. These restrictions may help to account for the longer duration of work journeys. On the other hand, very similar restrictions apply to school trips, yet except for journeys to tertiary institutions these are generally brief.

If work trips could be abbreviated, what would be the alternative uses of the time? One possible use is work itself. In Australia in 1974 workers who worked a standard week of just under 40 hours had a median journey to work lasting 24 minutes (ABS:JTW 1974). By contrast people who worked 49 hours and over had shorter journeys: 18 minutes median. However this difference in journey duration accounted for only about one hour a week of a ten hour difference in working time, and may in any case have been due to other factors. A working week of just under 40 hours is common in clerical employments, and because of the concentration of clerical jobs near the city centre office workers tend to have long work journeys. It therefore seems that savings in work travel time are not devoted to extra working time, but are likely to be spent at leisure.

If this reasoning is correct, workers have to weigh the benefits of time devoted to work travel against the returns from leisure foregone. In many cases those returns may be fairly minimal, and indeed if the travel involved is reasonably pleasant it may be preferred to the alternative leisure activity. However, as work journey duration increases so does the probability that it will cut into valued leisure activities. It may no longer be a matter of giving up a few minutes' television, but of being unable to go to the club on a weekday evening, or not being able to talk to the children because they are already in bed when the worker arrives home. Individual workers will have their individual opinions as to what constitutes a satisfactory duration for the journey to work, but as the duration increases more and more will begin to consider it too long. At first they are likely to express no more than mild dissatisfaction and not do anything about it, but as journey times increase they will become increasingly anxious to curtail their journey duration, perhaps by adopting faster transport or else by shifting jobs or moving to a house which will make the journey shorter. Very long-duration journeys will therefore be made only by people who are willing to yield a great deal of weekday leisure, and then only when
the alternatives in the way of a house nearer the job, or a job nearer home, are particularly unattractive. The Blue Mountains commuters into Sydney are necessarily a somewhat special breed.

It should be possible to observe whether people do in fact act in this way. Table 2.4 presents the results of a doorknock survey conducted in four Melbourne suburbs in 1971, in the course of which people were asked whether they felt their journeys to work were convenient. The proportion of respondents expressing discontent (in the very mild form of stating that their journey was less than 'very convenient') indeed rose with journey duration, though without any obvious point beyond which the duration was universally regarded as excessive. At around 25 minutes (which, perhaps significantly, was the average duration of all journeys to work in Melbourne) half the respondents complained of inconvenience. Motorists were more inclined to register inconvenience for the same journey duration than public transport travellers, who in turn were more inclined than pedestrians, which perhaps indicates that journey length also affected people's assessments. Though the point of inconvenience obviously varied between individuals, this Melbourne data would indicate that half an hour is about the time that an average worker considers reasonable for his or her journey to work.

Table 2.4 Inconvenient work journeys
Percentage of respondents in four Melbourne suburbs stating that their work journeys were less than very convenient

<table>
<thead>
<tr>
<th>Journey duration minutes</th>
<th>Overall</th>
<th>Travellers by mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 14</td>
<td>23</td>
<td>Car 28</td>
</tr>
<tr>
<td>14 - 23</td>
<td>34</td>
<td>Public transport 41</td>
</tr>
<tr>
<td>24 - 33</td>
<td>58</td>
<td>Walking 66</td>
</tr>
<tr>
<td>34 - 43</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>44 - 53</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>54 and over</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

Source: Urban Research Unit surveys made in 1971.

A second testable consequence of the hypothesis that long work journeys are unsatisfactory is that long-duration travellers should be more concerned to choose the fastest transport available than short-duration travellers. This is
true in so far as very few Australians walk or cycle to work when the duration of their journey by this means of transport would exceed 25 minutes. Faster means of transport are readily available, and a reduction of journey duration from (say) 30 minutes on foot to 20 minutes by bus or (better) 10 minutes by car is apparently thought worthwhile. Again, the modal choice studies show that people whose journey to work would take upwards of 40 minutes by public transport are willing to pay extra to have the journey speeded up.

Since the modal choice studies were confined to journeys in the 40 to 80 minute range they provide no evidence on whether people with short-duration trips are careless about their choice of mode. However, walking persists as a short-distance means of transport even when time savings would be possible by driving. Fifteen minute walks to work are still common; these could be reduced to under 10 minutes by car, but for most people such time is not worth saving. Not only do people forfeit these savings, but they persist in regarding any journey to work that can be made on foot as convenient.

Similar evidence may be gained by asking people their second-best mode of transport; that which they would use if their current means were not available. Such a question was asked of a sample of workers in Melbourne and Albury/Wodonga (Cities Commission 1975:70). Walking was chosen as the alternative means of transport sufficiently often to indicate that people were willing to walk up to 3 kilometres a day each way if need be - that is, for up to about 35 minutes a trip. Many of those with longer journeys, on the other hand, claimed that they had no alternative but to travel by car, and that if their own car were in dock they would have to seek a lift.

On this evidence any time up to half an hour may be taken as satisfactory for the journey to work of most Australians. Greater journey durations become progressively less satisfactory, and the probability increases that people will take steps to abbreviate their journey, whether by adopting faster transport or by seeking a job closer to home or a home closer to the job. In small cities such evasive action is usually relatively easy. There is little to prevent people from driving to work provided they can afford a car, and distances are short in any case. By contrast, in larger cities many workers will find it hard to cut journey times, particularly if they work in the city centre. Even company directors with free garages in their office basement will be hard put to reduce journey times below the half hour. One may therefore predict that few workers in provincial cities will have journey times more than 30 minutes, but that in large
cities such trips will be common, perhaps normal. This is in fact the case, for in small cities like Albury/Wodonga the average duration of the journey to work is around 15 minutes, rising to 27 minutes in Melbourne and 35 minutes in Sydney.

If half an hour is an acceptable duration for the journey to work, what of other kinds of journey? Unfortunately there are no studies of the acceptability of different journey durations comparable with the work trip studies. It has already been shown that trips for other purposes generally take less time than work journeys, which may indicate that the satisfactory duration for such trips is less, or that the returns to long travel times are less.

Conclusions

The introduction of faster transport generally results in people travelling further. If the marginal speed of the new method of transport is high (as it was when public transport substituted for walking) and the rewards of travelling further are considerable, the increase in journey distance might be accompanied by an increase in journey duration even to the point where that duration becomes unsatisfactorily long. Conversely when motoring is substituted for public transport on unsatisfactorily long trips there are likely to be time savings. However the general tendency is to maintain the duration and increase the distance of all trips other than those which are unsatisfactorily long.

The conclusion that faster transport is generally used to travel further is a dispiriting one for those who wish to take a value of time approach to the evaluation of the benefits of transport investments and subsidies. Even if it is accepted that the benefit is suitably measured by the toll which could be extracted from motorists for their use of a new road, or by the excess fares which could be charged to the passengers of subsidised public transport, the toll or excess fares are unlikely to be related to the value of time which is not saved. Yet distance is presumably not desired for its own sake, so we have to look further to identify its benefits, and perhaps seek a way of evaluating them.

Though it spoils the time savings approach to the evaluation of the benefits of road improvements, the idea of satisfactory journey duration can be used to make several predictions on the future of the different means of transport:

1. Walking and cycling will remain useful transport modes for shorter distance travel. The extent to which people will continue to use them will depend largely on the extent to
TRAVEL DISTANCE

which worthwhile destinations are to be found within walking and cycling distance of people's homes, and on the safety and pleasantness of the streets for walking and cycling.

2. Even though buses and trams are slower than cars, they can still provide for local journeys of up to 5 kilometres within the satisfactory travel time of half an hour. This means that buses and trams should not be written off as competitors for the private car in local transport. Whether they can in fact compete, however, depends on whether they can maintain their somewhat precarious present cost advantage over motoring, and on the extent to which worthwhile destinations are to be found within bus distance of people's homes, laid out in such a way that bus routes can effectively serve them.

3. Given the long walk/wait times associated with limited-stop public transport, this can only have a future in serving travel flows where both origin and destination are highly attractive, yet people are prevented from shortening their journeys by moving closer, or by motoring. In other words, their restricted market lies in central city traffic, plus the occasional long-distance trip of people without access to a motor car.
Transport and urban form

We have seen how urban passenger transport has become more expensive and speedy, and how journeys have lengthened. Improved technology and cheap fuel have enabled people to travel further without squandering too much time. Yet are these longer journeys sufficient reward in themselves for the extra expense? Some would say so. Longer trips are classed by the national accounts statisticians as an increase in consumption, and as such are said to betoken an increase in the standard in living. However, an alternative tradition in economics holds that transport is a derived demand. It is possible to cite many instances of travel indulged in for its own sake (tourism, Sunday driving, jogging, walking the dog) but these account for only a small proportion of the total daily mileage in urban areas. Most city travel is part of the price of carrying out various human activities in different places. It enables different groups of people to join together for different common purposes (work, recreation, schooling, marketing ...) without having to be together all the time. If urban residents were not willing to travel, housing, factories, shops and schools would have to be combined on top of one another - as indeed they were in some medieval cities. Regular daily travel is thus part of the price of the modern factory or office block (which employs too many people in too great variety for them all to live on the spot); it is equally part of the price of the residential area removed from the noise and grime of economic activity or of the football match between sides representing different suburbs.

Though travel is the price of the geographical separation of activities, there is no point in paying a greater price than necessary. Journeys are only justified if the traveller reaches rewarding destinations, and longer journeys are only justified as against shorter if these rewards are heightened. Sometimes the rewards of increased journey length are easily identifiable. In rural areas improved passenger transport has greatly reduced social isolation. It has enabled education departments to abolish the one-teacher school, and has made it possible for farmers' wives to do their shopping in large towns.
where the range of shops rivals the city. However, even here there have been drawbacks. Improved transport and longer journeys have brought about the slow decline of numerous small country towns, which in each repeated case has been accompanied by capital losses and blighted expectations.

Within cities there may have been similar costs and benefits. Sometimes these are quite plain in the lives of particular individuals. A particular family may find it easier to visit its friends and relatives in different parts of the urban area; a particular teenager may find it easier to enroll in trade school, and a particular housewife may find that she can reach larger and more exciting shopping centres rather than relying on the local corner store. A particular worker may find his or her range of job choice extended, and a husband and wife buying a house may find themselves able to consider a greater range of localities without over-extending his or her journey to work. Such benefits are obvious, and provide ample reason for individuals to seek to travel faster.

The trouble with this simple enumeration of the benefits individuals can receive when they become rich enough to graduate from slow transport to fast is that it makes no allowance for what happens when a large number of people make the change at about the same time. Even if each individual is rationally seeking the benefits of greater mobility, en masse their efforts may conceivably cancel out, and lead to a restructured city in which people carry on much the same activities as before at places which are no different from before save that they are further apart. An extreme form of this argument claims that the switch from public transport to motoring has caused such an increase in the acreage of roadways and car parks that activity centres have to be much more widely spaced, to the point where the wider spacing exhausts the potential benefit of faster transport. At the other extreme longer journeys might be associated with increased spaciousness in the design of houses, workplaces and recreation areas. A further possibility is that longer journeys might be a response to increased city size brought about by the growth of population.

City size

A prima facie case can easily be made that faster transport has led to larger cities, with greater populations accommodated at lower densities. Over the past century, during which the change was made from walking to mechanical transport, the population of Australia's two biggest cities increased by between 10 and 15 times, while their area grew by 30 times,
TRANSPORT AND URBAN FORM

halving their overall population density. If it can be shown that these changes were due to the adoption of faster transport, it follows that the long run benefits of speed have been the accommodation of population growth and the adoption of lower urban densities. It may then be argued that neither population growth nor lower densities were desired as ends in themselves, and that they in turn had costs and benefits, but before the argument proceeds to this length it has to be shown that there was a causal connection between transport speeds and city size.

Before attempting to show how faster transport allows greater populations to be accommodated at lower density, we must acknowledge that there are problems of measurement, particularly for density. These arise due to the difficulty of drawing the urban boundary. Alternative definitions may be adopted: the boundary may be drawn around the built-up area, or may extend to include the hobby farms and commuter townships on the urban fringe. The Australian Bureau of Statistics uses the former definition, drawing the urban boundary around all contiguous areas with a population density of 200 persons per square kilometre or more, including land completely enclosed by areas meeting the definition (Linge 1965). With the growth of ex-urban commuting and hobby farming this definition may be of decreasing relevance, but there is no workable competing definition, so it is used for the calculations reported in Tables 3.1 and 3.2.

Given urban growth the boundary inches outwards as new houses are added to the periphery, with occasional leaps as formerly separate towns coalesce with the urban area. The timing of these leaps cannot always be determined accurately, since it is not always obvious when the connecting arm of development becomes sufficiently strong to ring in the new area. This is the chief arbitrary element in applying the definition, given a detailed knowledge of where people live.

For censuses before 1954 we lack this detailed knowledge, since results are available only by local government area. It is possible to tell from overall densities which local government areas were completely built-up, but for those on the fringe there is no alternative but to take a portion of the area and a somewhat larger proportion of the population. Both these calculations are matters of judgment, aided where possible by old maps. It is of some comfort to know that overall density is not very sensitive to minor changes in boundary. The urban boundaries drawn according to these definitions are show on Maps 3.1 and 3.2, while the resultant statistics are displayed in Tables 3.1 and 3.2.
Table 3.1 Melbourne: population, density and area

<table>
<thead>
<tr>
<th>Year</th>
<th>Population '000</th>
<th>Dwellings '000</th>
<th>Area km</th>
<th>Persons/dwelling</th>
<th>Population density persons/sq km</th>
<th>Dwelling density dwellings/sq km</th>
<th>Hypothetical radius km</th>
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<tbody>
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<td>1881</td>
<td>217</td>
<td>43</td>
<td>53</td>
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<td>4070</td>
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<td>750</td>
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<td>124</td>
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<td>710</td>
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<td>1660</td>
<td>520</td>
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</tbody>
</table>

Source: Censuses

Definitions:
- Urban boundary approximately at 200 persons per sq km.
- Hypothetical radius: Radius of the urban area if this population were living at this density in a circular city on a boundless plain.
Table 3.2 Sydney: population, density and area

<table>
<thead>
<tr>
<th>Year</th>
<th>Population '000</th>
<th>Dwellings '000</th>
<th>Area sq km</th>
<th>Persons/sq km</th>
<th>Popula-</th>
<th>Dwelling density persons/</th>
<th>Hypothetical population density per sq km</th>
<th>Hypothetical Population density per sq km</th>
<th>Average Hypothetical population density per sq km</th>
<th>Average Hypothetical distance from city centre km</th>
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<tbody>
<tr>
<td>1881</td>
<td>182</td>
<td>34</td>
<td>34</td>
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Source: Censuses (see Table 3.1); MWSDB.
Notes on MWSDB Data: From Metropolitan Water, Sewerage and Drainage Board Annual Reports, Plans and Maps, per Dr B Firestone. These figures are included as an independent check on the adjusted census estimates, since they do not depend on the drawing of a density-based urban boundary. Instead they are based on the urban area for water reticulation purposes. This has always been larger than the urban area defined on a population density basis, since the Water Board early in its existence extended reticulation to the fringe zone of market gardens and chicken farms. These extensions were especially widespread from the 1920s to the 1950s, hence the very much lower population density reported by the Water Board in this period. Of late the built-up area by the census definition has filled out a greater proportion of the Water Board area, hence the convergent densities in the 1960s and 1970s. The Water Board estimates also include a figure for the hypothetical radius which was not derived directly from the area, but rather as a multiple of the average distance of dwellings in the Water Board area to the city centre. (In a single centre city with uniform density the radius will be 1.5 times the average distance from dwellings to the centre.) These estimates still reflect the greater size of the reticulated area, but despite this lie close to the census estimates, with which they converge over recent years. Allowing for differences of definition the Water Board figures thus confirm the general trend of the census estimates.

The maps summarise nearly a century's history for both Melbourne and Sydney. During the 95 years from 1881 to 1976 Melbourne grew in population 11 times and in area 28 times, allowing a reduction in population density to 41 per cent of its 1881 level. The changes in Sydney were even more marked: population up 15 times, area up 43 times, and density reduced to 36 per cent. These greater changes in Sydney were due not so much to its being larger than Melbourne at the end of the period, but smaller and denser at the beginning.

The reduction in population density in both cities can be divided into two parts, first, a reduction in the number of people per dwelling, and second, a reduction in the number of dwellings per square kilometre. In both cities over the 95 years the dwelling density fell to about two-thirds of its 1881 level, the remainder of the reduction in population density being due to a fall in the number of people per dwelling. In
part this latter reduction was due to smaller families, with less children, but it also reflected increasing incomes which enabled people who would formerly have shared a house to live separately. Young people have been able to leave home earlier
and old people have been able to live by themselves rather than moving in with their middle-aged children, while boarding houses have virtually disappeared as a common kind of accommodation. Taken by itself this trend towards reduced numbers of people per dwelling might lead one to predict an increase in dwelling density, since elderly couples and single young people do not require large houses. The fact that the reverse has occurred is therefore even more significant than would appear at first sight. In the following discussion attention will be focussed on the dwelling density rather than the population density, for it is the dwelling density that more directly reflects decisions about the amount of space that should surround each house.

Though the increase in population, number of dwellings and area of Sydney and Melbourne has been of similar magnitude over the past century, there have always been differences between the two cities. Sydney started out in 1881 with a smaller population and a much smaller area, a difference which had been accentuated by 1891. As reflected in the history of its suburban railways, the land boom of the 1880s was much more frenetic in Melbourne. The Victorian capital more than doubled its area, population and number of dwellings over the decade. In Sydney growth was also rapid, but it amounted to less than a doubling. By contrast, in the depressed 1890s Melbourne actually lost dwellings, while Sydney continued to grow in area, population and housing - this growth being supported by the construction of an extensive tramway system and by the development of suburban railways.

Even after growth had revived in Melbourne, it continued for over a generation to lag behind Sydney. After 1901 Sydney had the greater population; after about 1905 the greater number of dwellings, and after 1911 the greater area. Further, dwelling densities were tending to increase in Melbourne, while they were falling in Sydney, and after about 1915 the overall dwelling density of the New South Wales capital was less. Melbourne was filling out within boundaries established by the railway extensions of the 1880s land boom, whereas Sydney was adding new suburbs, particularly in the hilly areas north of the Harbour where a great deal of steep land was included within the urban area even though at this stage it could not be built on.

The depression of the 1930s and the war of the 1940s failed to halt the decline in the number of people per dwelling in either city, but these two decades did witness a pause in the secular decline of dwelling densities, which increased noticeably particularly in Sydney. Though the depression and
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Map 3.2 Sydney: hypothetical radius and actual boundary 1881, 1947 and 1971.
subsequent war contributed to this increase in density by limiting the capital available for suburban extension, it may also be that by the 1930s the cities had reached a size where further growth in area entailed excessive public transport journey times, and people were beginning to prefer inner area flats to outer suburban cottages.

After the Second World War both these contraints were removed, and the era of motorisation was one of rapid population growth accompanied by falling dwelling densities. This time it was Melbourne which led the growth, and though its total population failed to catch up with Sydney its dwelling density fell more rapidly so that by 1976 it was the larger city in area if not population. However, the size of Sydney was perhaps underestimated since the boundary excluded the urban area around Gosford, which developed rapidly from the 1960s on.

Travel distances and city size
A connection between the speed of transport and the physical size and density of cities is likely to arise because the maximum travel distances which can be accomplished within a satisfactory time by the different means of transport limit the spread of the urban area. As shown in Chapter 2, there is such a thing as a satisfactory journey duration, and given the speed of each means of transport this translates into a maximum journey distance which people will not willingly exceed on regular daily trips. Since the journey to work is generally the regular daily trip which most threatens to exceed these limits, it is likely that the constraints of travel times and speeds on urban growth will be felt through limits to work journeys, which in turn will place limits on the distances which can separate workplaces and people's dwellings.

According to the evidence presented in Chapter 2 people's willingness to spend time travelling has changed little over the years. A journey to work of an hour or more each way is only acceptable when it is not possible to switch to faster transport and when there are strong incentives not to seek a job nearer to home, or a home nearer to the job. At walking speed an hour's journey translates into a distance of about 4 kilometres; at tram or bus speeds about 12 kilometres; at suburban railway speeds and walk/wait times about 20 kilometres, and at motoring speeds into as little as 20 kilometres for journeys mainly in the inner suburbs, and as high as 35 kilometres on the fringe. The public transport distances are very sensitive to the existence of appropriate
routes and services, and might be increased considerably for journeys with low walk/wait times and express trains; the motoring distances are similarly sensitive to the state of traffic congestion. Even so, it remains that the distance which can be covered in a satisfactory time by any particular means of transport is finite, and potentially restricts the size of the urban area.

The only case where this restriction can be translated directly into a limit to the urban area is the special case where all jobs are at the centre of the city. In such a city the maximum acceptable journey distance by the available means of transport limits the radius of the urban area. In more complicated city layouts, where the jobs are dispersed across the urban area, there is no such simple restriction. However, as soon as the diameter of the urban area exceeds the maximum travelling distance, some of the city's jobs move out of range of at least some of its citizens. Jobs in the far northern part of the city are irrelevant to those who live in the far south, and people's effective choice of jobs is curtailed to less than the total available in the urban area. In some particularly sprawling urban areas this may become a considerable restriction, and journey times may continue to exert an influence limiting the outward expansion of the suburbs and exurbs. However, it is also arguable that with motor cars for transport and with dispersed employment opportunities transport times provide no effective limit on the size of urban areas. The distances that can be covered by car within a satisfactory time, particularly when the car is travelling on an uncongested freeway at or beyond the urban fringe, make it easy for those who work in the relatively uncongested outer suburbs to live in the country far from the madding crowd. In these circumstances it is arguable that the limitations to city size, and to reductions in density, come not from transport considerations but from such costs as the expense of converting rural to urban land: the cost of buying it out of agricultural use, and of providing streets, water supply and other urban services. Cultural factors may also be involved, for though Australia is heir to the arcadian tradition of England, reinforced by nostalgia for the bush and by the sheer usefulness of a large garden (Halkett 1976), there are limits to the amount of space people want. Some with a taste for urban life may indeed prefer to live at high densities in flats. Similarly there may be limits to the ways in which town planners and speculators can conspire to reduce densities. Large public reserves incur maintenance charges, and large speculative land holdings incur holding charges, and
town planning regulations may limit the conversion of land from rural to urban use. All this, as well as historic inertia, helps to explain why cities remain bounded, rather than spreading at extremely low densities across the surrounding farmland – which, given motor transport, they could well do without imposing unbearable journey durations on residents.

If there is, or at least has been, a connection between the maximum journey length and the size and density of cities, this should be apparent in two relationships: first, actual average journey distance should increase as the maximum satisfactory distance increases due to the adoption of faster transport, and second, increases in the actual average distance should be reflected in increases in the size of the urban area. The first of these propositions has already been discussed in Chapter 2, and it was shown that average work journey distances have increased with faster transport so as to leave average journey duration constant at around half an hour, or half the postulated maximum satisfactory duration. It remains therefore to consider the relationship between journey length and city size. This will be done for the two largest Australian cities, since it is in large cities that maximum journey distances are most likely to affect the urban layout.

As a city expands in area, the distances separating the different parts of the city expand proportionately. In a square city they expand at the same rate as the sides of the square and hence proportionally to the square root of the area; in a circular city they rise proportionally to the radius. We should not therefore look for a relationship between the average journey distance and the area of the city as such, but rather between the average journey distance and the square root of the area, or the radius of a circle of the same area as the city. Neither Sydney or Melbourne are squares or circles, but perhaps they more nearly approximate circles than squares, and therefore we will express their area in terms of the radius of circular city of equivalent density. This will be termed the hypothetical radius.

As Table 3.3 shows, between 1881 and 1976 the hypothetical radius of Sydney increased by 6.5 times, and that of Melbourne by 5.3 times. The increases in average work journey distance were of a similar order. While this does not prove a causal relationship, it at least accords with the hypothesis that city size and journey distances are related.

As already pointed out, a causal relationship can easily be posited in the case of the circular cities of abstract, oversimplified theory (Evans 1973). If all jobs are at the city centre, the radius is set by the maximum journey
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distances. If this maximum increases, the radius will increase to accommodate population growth and take advantage of the benefits of lower density. If the urban area is developed at a uniform density, the average length of the journey to work will be two thirds of the radius, plus whatever allowance is necessary for the fact that street patterns are rarely completely radial. If the inner suburbs are more densely developed than the outer, the average distance to work in the city centre will be less than two thirds of the radius. If the urban area is not a perfect circle, but has arms which stretch beyond the hypothetical radius, the average distance to work in the city centre will be more than two thirds of the average distance from the centre to the circumference.

Given the irregularity of shape and patchiness of density of the two cities, it may be calculated that the average length of the journey to work in Sydney and Melbourne, if all the residents of each city lived where they did at each Census but worked in the city centre, would have been a little less than the hypothetical radius of each city at the Census date. In neither Sydney nor Melbourne are jobs concentrated entirely in the city centre, so the average length of the journey to work has therefore been less than that predicted from the single-centre model. During the walking era in both cities the average length of a journey to work was around 60-70 per cent of the hypothetical radius; during the public transport era it rose to 80-90 per cent, and since motorisation has fallen rapidly back to 60 per cent or less (Table 3.3 and Chart 3.3). In the public transport era the average length of the journey to work increased rapidly in relation to population growth, but since motorisation the increases have moderated to a point where, since about 1960, the average distance covered on a journey to work in both Sydney and Melbourne has remained constant even though both the population and the hypothetical radius have continued to grow. These changes in the relationship between journey distances and the hypothetical radius indicate that urban form has responded, not only to the increases in journey distance made possible by increases in speed, but to the fact that walking and motoring, at their different speeds, provide transport with equal facility in any direction, whereas public transport is route-bound.

Walking cities were compact, and with considerable intermixture of housing and workplaces - hence the average journey distances rather less than those predicted in the single-centre model. However, with the introduction of public transport the urban area was expanded by the addition of a ring of largely residential suburbs, connected to the older central
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parts of the city and the jobs in those areas by suburban railways and tram lines, and housing mainly the middle classes who could afford to pay train fares. The reasons why housing was decentralised and jobs were not had to do with the benefits of bucolic suburbs, untainted by the smoke and noise of factories; and with the failure to modernise on-road freight transport until well into the twentieth century, which left many places of employment tied closely to the wharves and rail terminals (Moses and Williamson 1967). Whatever the cause, the result was the centralisation of employment relative to dwellings, and a rise in the average length of the journey to work relative to the hypothetical radius.

### Table 3.3 Predicted and estimated average work journey length (km)

<table>
<thead>
<tr>
<th>Year</th>
<th>Hypothetical radius</th>
<th>Estimated average distance</th>
<th>Year</th>
<th>Hypothetical radius</th>
<th>Estimated average distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>public transport overall</td>
<td></td>
<td></td>
<td>public transport overall</td>
<td></td>
</tr>
<tr>
<td>1881</td>
<td>3.3</td>
<td>2</td>
<td>1881</td>
<td>4.1</td>
<td>2</td>
</tr>
<tr>
<td>1891</td>
<td>4.6</td>
<td>3</td>
<td>1891</td>
<td>6.3</td>
<td>4</td>
</tr>
<tr>
<td>1901</td>
<td>5.7</td>
<td>3</td>
<td>1901</td>
<td>6.3</td>
<td>4</td>
</tr>
<tr>
<td>1911</td>
<td>6.8</td>
<td>5</td>
<td>1911</td>
<td>7.5</td>
<td>5</td>
</tr>
<tr>
<td>1921</td>
<td>9.2</td>
<td>7</td>
<td>1921</td>
<td>8.0</td>
<td>6</td>
</tr>
<tr>
<td>1933</td>
<td>11.5</td>
<td>8</td>
<td>1933</td>
<td>9.7</td>
<td>7</td>
</tr>
<tr>
<td>1947</td>
<td>13.0</td>
<td>9</td>
<td>1947</td>
<td>10.8</td>
<td>8</td>
</tr>
<tr>
<td>1954</td>
<td>14.7</td>
<td>10</td>
<td>1954</td>
<td>13.4</td>
<td>9</td>
</tr>
<tr>
<td>1961</td>
<td>17.9</td>
<td>11</td>
<td>1961</td>
<td>16.6</td>
<td>10</td>
</tr>
<tr>
<td>1971</td>
<td>21.3</td>
<td>11</td>
<td>1971</td>
<td>20.5</td>
<td>10</td>
</tr>
</tbody>
</table>

Note: The single-centre model predicts average work journey length at 66 per cent of the radius. This has been adjusted upwards to 85 per cent to allow for the indirectness of transport routes.

Once the suburbs had expanded to the limit of tolerable travelling time by suburban trains, and given the continued centralisation of employment, it looked as though the further growth of population would have to be accommodated by increases in density. This point was almost reached in Sydney and Melbourne in the late 1930s. However, the threatened increases in density did not occur, first, because motorisation increased tolerable journey distances, and second, because the motor car
and motor truck meant that jobs no longer had to be located near the city centre. Both cars and trucks could go in any direction, and indeed if too many tried to go in the same direction at once congestion ensued. In this they were the opposite of public transport, where the heavier the traffic on a given route the better the service. Whereas public transport tended towards the centralisation of jobs and activities, motoring encouraged their diffusion. Jobs once again became scattered throughout the urban area, as they had been, at a different density, during the walking era. However, densities were now much less than in walking cities, and this diffusion did not threaten the destruction of the purely residential suburb, since at the new much broader motoring scale of distances housing and employment could be kept visually separate without being far away in journey time.

Chart 3.3 Population, average work journey distance and hypothetical radius: Sydney and Melbourne 1881-1971

The diffusion of employment had the further effect that journey distances no longer placed strict limits on the size of the urban area. Housing estates could be added to the fringe of the built-up area in the knowledge that they would be within reasonable journey distance of the jobs in that sector of the metropolitan area, even if they were beyond a satisfactory travelling distance from the city centre, or from the jobs in
other sectors of the city. Motoring cities thus came to differ considerably from the centralised cities of the public transport era. In public transport cities it was only necessary to get to the centre of the city in order to have the choice of all (or nearly all) the jobs in the city. In the more diffused motoring city many of the city's jobs were likely to be out of travelling range of some at least of the residents. The question therefore arises: were the lower densities of the 1960s and 1970s purchased at the expense of a reduced range of job choice?

Transport and urban form in a scattered city

In a city where both jobs and dwellings are scattered patchily over the built-up area any limits which transport technology and the maximum tolerable journey duration place on urban form will be felt largely through the limitations they impose on the field of choice. If the urban area becomes so diffuse and scattered that the number of jobs within commuting range of at least some suburbs falls to the point where people feel their choice of jobs is limited, there will be an incentive to increase densities. Again, restrictions may be imposed by the need to be within commuting range of one-of-a-kind facilities, such as an employment zone surrounding the port (or airport) or a major manufacturing complex like a steelworks. These limitations to urban sprawl are not nearly so compelling as the limits imposed by commuting distance in a single-centred city, and indeed the size of scattered cities is as likely to be limited by factors such as agricultural land prices, scenic reserves and the costs of extending water and sewerage to low-density developments as it is likely to be limited by transport considerations. Even so, it is of considerable interest to watch the interplay of journeying range and job choice, and speculate on their effect on urban form and journey distances.

One way to describe work journey options in a scattered city is to calculate the average journey distance which would result if everybody took the nearest job, and contrast this with the distance which would result in the unlikely event that everybody took the furthest job, in each case given their residential location. Approximately half way between these two figures lies a third, which is the average distance which would result if people picked their jobs in total disregard of journey length; that is, without any effort to maximise or minimise journey distance. This third, middle distance is the analogue in a scattered city of the predicted average distance in a single-centred city, for it is the average journey length
which would result if people chose their jobs from the whole range of jobs available in the metropolitan area, just as the residents of a single-centred city do when they come to the city centre and there make their choice. The observed average journey distance in a scattered city is likely to lie between the minimum and this average full-choice. The closer it lies to the minimum, the more people are sacrificing choice to convenience; the nearer to the middle figure, the more they are exercising choice at the cost of journey distance.

Calculations of this kind for Sydney and Melbourne produced estimates of the random choice distance generally a couple of kilometres less than the hypothetical radius, and hence similar to the predicted average work journey length in the equivalent single-centre city (cf Tables 3.3 and 3.4). This similarity of prediction allows us to reach two tentative conclusions. First, the length of the average work journey which would arise if people chose their jobs at random from the whole field available in a dispersed city like Sydney or Melbourne is of the same order as that which would arise were the same number of jobs concentrated in the centre of a city of similar population and density. At equal levels of choice the length of journeys does not seem to be much affected by whether jobs are concentrated or dispersed, though the pattern of journeys - radial in the first case, diffused in the second - would be very different. Second, the fact that actual travel distances are less than the full-choice distance means that in both Sydney and Melbourne people have sacrificed job choice in favour of shorter distances.

Table 3.4 Maximum and minimum average work travel distances (km)

<table>
<thead>
<tr>
<th></th>
<th>Maximum</th>
<th>Full choice</th>
<th>Minimum</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sydney</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1945</td>
<td>18</td>
<td>12</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>1961</td>
<td>24</td>
<td>15</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>1971</td>
<td>29</td>
<td>17</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Melbourne</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1951</td>
<td>12</td>
<td>8</td>
<td>4</td>
<td>8.5</td>
</tr>
<tr>
<td>1961</td>
<td>22</td>
<td>13</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>1971</td>
<td>26</td>
<td>15</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

Calculations by Tony Katakos.
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In so far as we can tell from the relationship between the actual average length of the journey to work and the predicted full-choice average, Melbourne at the end of the Second World War was a single labour market, in which workers chose their jobs without much regard for geographic proximity. On the other hand, in Sydney they were already sacrificing a degree of choice in favour of shorter journeys. As the scale of both metropolitan areas increased this tendency to choose from but part of the metropolitan stock of jobs became more pronounced. Journey length increased a little, but not as much as might be expected given that many people were at the time changing to faster transport. Since the total number of jobs available was increasing, this does not mean that the number from which people chose was falling, but it does imply that they no longer regarded the whole metropolitan area as providing potential workplaces. The dispersion of jobs in the post-war period thus began an era of geographically-segmented metropolitan labour markets.

Though the growth in the physical size of the metropolitan areas provides the major reason for the sacrifice of choice and the rise of geographic segmentation in metropolitan labour markets, it is not the only reason. An important contributing factor was the entry into the labour force of increasing numbers of working mothers with strong preferences for short journeys to work (Manning 1978:Ch 5).

A regional approach to job markets in Sydney and Melbourne

This description of how Sydney and Melbourne work as scattered cities has so far dealt only at the aggregate level, and made no allowance for the fact the opportunities vary a great deal between suburbs. To observe these differences of opportunity and the differences of behaviour they engender it is necessary to resort to a regional approach. The steps in this approach are as follows:

1. Each metropolitan area is divided into regions.

2. The number of jobs in each region is balanced against the number of resident workers. This gives the proportion of the resident workforce which could work locally if the minimisation of travel distance were the over-riding factor in job choice.

3. The proportion of the resident workforce actually holding jobs within the same region is also calculated. This
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proportion is necessarily equal to or less than the proportion which could work locally.

4. The number of resident workers holding local jobs is then expressed as a proportion of those who could do so. This proportion may be called the response rate, for it measures the extent to which people respond to the opportunity to work locally.

In a metropolitan area where there was complete correspondence between the pattern of employment and of dwellings all people could work locally, and the proportion actually working locally would depend on the response rate alone. However, in most actual urban areas some regions will have an excess of jobs and others a shortage. This means that over the whole metropolitan area some workers will be unable to work within the same region, but will have to travel daily from the job-deficit region in which they live to work somewhere else. Even if everybody sacrifices job choice and tries their hardest to work locally such travel will be unavoidable. Over the whole urban area, then, the number able to work locally will comprise the total of those able to work locally in each region, being the total of jobs available in job-deficit areas and workers available in job-surplus areas.

The familiar variables of the single-centre model do not appear as such in this description of the urban job market. Average journey distance, however, is closely related to the proportion working locally. If the proportion working locally goes down, it is highly likely that average distance travelled has increased, and vice versa.

The adoption of speedier transport in circumstances where people are satisfied to spend a constant time travelling may affect a scattered, regionalised city in two ways. First, it would enable people to live further from where they work, and so may create job deficit regions and worsen the local balance between jobs and dwellings. Second, it may encourage people to take jobs further from where they live, and so reduce response rates. In effect the benefit of faster transport is that people living in a given place can choose their jobs further afield, perhaps even to the extent where they can disregard distance and choose a job anywhere in the metropolitan area. Similarly those working in a given place can choose their house further afield. This is likely to lead to the extension of the urban boundary and a reduction in overall density as new job-deficient residential areas are added to the urban fringe.

The local balance between jobs and housing can also change
as a result of initiatives on the employers' side. If more jobs are provided in job-deficit regions more people will be given the opportunity to work locally - but will they take it? This question can be answered by watching the behaviour of response rates, for if they decline in a region where the job deficit has been reduced then the opportunity has to that extent been missed.

In applying this theory to Sydney and Melbourne, it is necessary first to divide them into regions. In a previous book I used a fairly sophisticated definition of a region, in which the proportion working locally was worked out using what amounted to a 3 kilometre geographic moving average (Manning 1978:Ch 4). This approach is not possible without detailed statistics, and such have only been available since 1971. Indeed, the Melbourne 1951 statistics are available only for regions so large that there is little option but to use the areas so defined, and match them for 1961 to give a comparison. However, for Sydney in 1945 and for both cities in 1961 and 1971 workers' dwellings and workplaces are given by local government area. Since the municipalities of both cities vary greatly in area, the best approach is to amalgamate them into regions of approximately similar size. If this is not done the proportion of workers shown as working in their home region might change simply because the distribution of the population had changed from small local government areas to large, without any actual difference in the propensity to work locally. Accordingly, both Sydney and Melbourne were divided into regions of around 50 square kilometres each, these being mostly single local government areas in the outer suburbs and collections of them in the inner.

In both Sydney and Melbourne the proportion of workers able to work locally seems to have remained about constant during the 1950s. In Sydney about two-thirds could have found jobs in the same region; in Melbourne perhaps a little less (Table 3.5). In this decade, therefore, the outward spread of jobs no more than kept up with the outward spread of the population. In Melbourne (there being no figures for Sydney) the overall response rate went down, and the proportion working locally followed it, an observation consistent with the increase in average journey distance. Faster transport permitted people to place less emphasis on nearness when choosing a job (Maher and O'Connor 1978).

During the 1960s local balance improved in both cities. If motorisation encouraged the building of new suburbs in inaccessible locations it equally encouraged the dispersion of employment, and the net result was an increase in the
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proportion of the population which could work locally. However, this improvement was accompanied by a further reduction in the response rate. In Sydney the proportion able to work in the same region rose from 66 to 71 per cent, but the proportion actually doing so remained constant, and similarly for Melbourne where the increase in the percentage able to work locally was from 64 to 70. This is consistent with the finding that journey distances were roughly constant during the decade. So many people gained access to fast transport that the opportunity to reduce distance was not taken.

Table 3.5 Residents working the same region
Sydney and Melbourne

<table>
<thead>
<tr>
<th></th>
<th>Sydney</th>
<th>Melbourne MMBW Planning Zones Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1945</td>
<td>1961</td>
</tr>
<tr>
<td>Percentage able to work in the same region</td>
<td>67</td>
<td>66</td>
</tr>
<tr>
<td>Percentage working in the same region</td>
<td>-</td>
<td>39</td>
</tr>
<tr>
<td>Response rate (%)</td>
<td>-</td>
<td>59</td>
</tr>
<tr>
<td>Percentage able to work in the same region</td>
<td>61</td>
<td>61</td>
</tr>
<tr>
<td>Percentage working in the same region</td>
<td>39</td>
<td>37</td>
</tr>
<tr>
<td>Response rate (%)</td>
<td>65</td>
<td>61</td>
</tr>
</tbody>
</table>


A comparison between the two cities is possible only for 1961 and 1971, the years in which the regions were defined on similar principles. The proportion able to work locally was about the same in each city, but response rates were higher in Sydney, as was the proportion actually working locally. This correlates with the general impression that inter-suburban transport was less convenient in Sydney, due mainly to the obstruction caused by the Harbour. Where local transport is slow people will have a greater incentive to work locally. However, this higher proportion working locally clashes with the observation that average journey distances were longer in Sydney. The two observations can only be reconciled by proposing that the higher proportion of short, local journeys
to work in Sydney was outweighed by a relatively high proportion of long journeys. This would be quite believable, since the proportion of the Sydney workforce working in the central business district was higher than in Melbourne and CBD workers on average have long journeys to work.

These several contrasts, changes and constancies were the net result of compensating and no-so-compensating changes in different parts of the two metropolitan areas, described in detail in the Appendix at the end of this book. Yet despite the complexities and the differences of response in different regions, the overall conclusion is that people reacted to the suburbanisation of jobs by sacrificing some of the job choice offered by the growth in total employment in favour of shorter journeys. This sacrifice was particularly common among married women, who came to form an increasing proportion of the workforce (Manning 1978:Ch 5).

The fact that many people deliberately chose local jobs meant that, for them, the increase in the size of the metropolitan job market through increasing population brought no benefit. In their case greater benefits may have come from the dispersion of jobs, which in many suburbs improved people's chances of obtaining a job locally. Faster transport also increased local job choice by extending the definition of the local area. On the other hand, people without access to cars found their mobility circumscribed as public transport deteriorated and (more important) as facilities spread out into a pattern well adapted to motor cars but quite unsuited to the provision of high quality public transport services. Such reductions in mobility were experienced in an acute form by non-motorists who moved to the outer suburbs.

The contribution of the motor car to reducing density despite increased population was thus due, not only to its faster speed, but to its ability to travel speedily in any direction, in contrast with the route-boundedness of public transport. It enabled employers to set up businesses in suburban locations not well served by public transport and to adopt patterns of workplace layout which could not be well served because the number of employees per hectare was too low to support a high-quality bus service from the suburbs round about, let alone a rail service. Similarly it enabled people to live in suburbs which lacked public transport from the start, since they were spread out too thinly and since their street patterns were unsuitable for buses. On the other hand, the role of motorisation in promoting suburban decentralisation should not be exaggerated. Back in public transport days Sydney had a major outer suburban concentration of jobs at

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Parramatta/Auburn, and even had the main mode of passenger transport remained public employment decentralisation would have taken place, though perhaps not to the same degree nor in the same pattern.

If this be a true account of the benefits of the adoption of the motor car for the journey to work, can an analogous account be given for the switch from walking to public transport? The answer is no, for we do not know what happened to the balance between workplaces and dwellings before 1945. However, it is generally believed that the trams and trains enabled the suburbs to spread out while employment was still tied to the inner areas by the lack of similar improvements in goods transport (Moses and Williamson 1967). The increase in average work journey length compared with the hypothetical radius, and the relatively high degree of centralisation of employment at the end of the public transport era, support this view. Another piece of evidence in its favour is that the industrial suburbs of the 1880s, on anecdotal evidence, seem to have had a fair local balance between jobs and residents (Barratt 1971:Ch 6). As these suburbs became 'inner' with the addition of new rings of residential suburbs, employment as a whole became relatively centralised. However, Parramatta/Auburn in Sydney reminds us not to go too far in claiming that public transport inevitably centralises.

This account of the relationship between transport and urban form has concentrated on the journey to work. Limits on work journey duration were translated into limits to the physical size of the urban area, and hence (given the population) into as limits to the density. There is no reason or principle why journeys for other purposes should not take on a similar role: for example, in a holiday resort walking distance from the beach may determine the shape of the built-up area in much the same way as walking distance from the centre did in a nineteenth century single centred city. However, as a matter of practical observation work journeys are longer than any other kind of trip undertaken on a regular daily basis in urban areas, and accordingly are the most likely to influence the size and shape of the city. It makes little sense to look to non-work trips as determinants of overall metropolitan size and density. On the other hand, they too have been sped up, some more than others. What have been the effects of this on metropolitan layout, and what have been the benefits?

The layout of urban facilities

In the foregoing account of the influence of work travel on urban layout it was assumed that both the location of dwellings
and of workplaces are subject to market forces. Developers and builders do not provide houses in places where people are not willing to buy them, and employers consider their ability to recruit a suitable workforce in selecting the sites for their factories, warehouses and offices. Somewhat similar considerations apply in some other areas of urban activity, particularly in retailing, where geographic location has an important influence on the profitability of stores. On the other hand, the locations of many other urban facilities are determined by administrative decision, with or without political involvement. In making their decisions administrators may be careless about geographic convenience, in which case we would not expect any particular response to changes in the means of transport available. On the other hand, they may regard geographic convenience as an important element in their decisions, in which case their decisions may be consciously influenced by changes in the means of transport available.

Though historical information on the location of various urban facilities, and on the distances travelled to them, is even more seriously lacking than it is for workplaces and the journey to work, it is often possible to describe the changes due to motorisation by comparing the inner suburbs, developed before the motor car, with those areas built-up since World War II. This method will be used several times in the following brief assessments.

Shops

Like jobs and houses, shopping centres in Australia are usually provided by the private sector. Town planners may try to influence their location, and sometimes government authorities control the siting of particular facilities (like post offices and also, through the licensing courts, hotels) but it is the private retailers who mainly decide where shops are to be built (Neutze 1978:184). Geographers conventionally describe the pattern which develops under untramelled private ownership in terms of a hierarchy, from small local shops serving common needs grading up through shopping centres of increasing size till the top of the pyramid is occupied by the city centre itself (Johnston and Rimmer 1969:19). Each level of the hierarchy serves a larger catchment and sells a wider variety of merchandise. In its schematic way this hierarchy described the shopping facilities of the typical public transport city quite adequately, the main cause of dispute being the exact number of levels and the characteristics by which each might be identified. However, just as the
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scattering of workplaces made possible by the motor car meant that the single-centre model became less adequate as a description of work travel, so car-induced changes in the pattern of retailing have reduced the relevance of the geographers' hierarchy.

The position of the city centre at the apex of the pyramid depended on its being the point of maximum accessibility from the suburbs. By public transport no other point in the metropolitan area could draw customers with anything like equal convenience from as many suburbs. However, with the spread of car ownership this uniqueness disappeared. Retail developers could now pick a suburban paddock, trick it out with a shopping mall and a large car park, and expect to draw custom from a whole sector of the urban area. The range of merchandise available in such malls could easily approach that on sale in the city centre, though without the same range of competing stores. Apologists for the developers argued that the malls made retailing much more accessible to suburban residents. However, in most cases the malls fell far short of the regional urban centres which the post-war generation of town planners had envisaged to take the strain off the city centre (Alexander 1979). In Sydney control was exercised so that the centres were reasonably accessible by public transport, but in Melbourne the malls were quite separate from all previous suburban centres. Bus routes had to be changed to serve them, often resulting in a pattern of routes satisfactory neither from the operators' nor the passengers' point of view. Again, commercial, welfare and recreational activities which could not afford the rentals charged within the mall had to go elsewhere, and in many cases they dispersed to low cost sites difficult to reach by anything other than private cars. The same happened to the offices and small industries which in former times would have been developed close to the shops to give employees access to lunch-hour shopping and make use of a common set of transport routes. Thus while the shopping malls indeed enabled people to cut down on the number of shopping trips they made to the city centre, they contributed to the scattering of lower-order retailing and in general improved conditions for motorists but not for others.

At the lower end of the hierarchy the greater mobility made possible by motoring led to the decline of the neighbourhood shopping centres, which had formerly been developed as a matter of course within walking distance of people's homes (Stretton 1975:52). Once again the big retailers were partly to blame. Neighbourhood shops were generally a small businessman's proposition, and it was to the big retailers' advantage if
trade could be diverted to a lesser number of high-volume outlets. On the assumption that everybody had cars, neighbourhood shops in many new suburbs were either reduced to a single 'convenience' shop or omitted entirely, while the retailing strength of the second-order centre was also reduced. Local trade was instead directed towards the sub-regional centres, located approximately 10 kilometres apart, and therefore for most people inaccessible on foot and only moderately accessible by bus.

The effect of motorisation on retailing has thus been to convert a hierarchy of shopping centres in which perhaps five levels could be recognised to one with only two or three levels. The decentralisation of the retailing function of the city centre to the major suburban shopping malls has reconciled the growth of the urban area with reductions in the length of major shopping trips, but the declining retailing strength of the local shopping centre has increased travel distances for day-to-day shopping. For those with cars to cover the distance and to convey their purchases home, the shift from neighbourhood to sub-regional shopping centres has presumably been worthwhile in terms of lower prices and increased choice, but for those without cars the story is different. There also remains the suspicion that the changes in retailing have been to the benefit of the large stores against the interests of the small businessman.

Schools

Unlike shops, schools are generally located by administrative decision. Public policy has attempted to equalise opportunity through education, and this has included an effort to equalise opportunity geographically. In so far as this policy has succeeded the location of schools should not influence people's decisions as to where to live. However the policy has not extended to equalising the opportunity to attend the superior private schools, and ambitious parents who are wealthy enough to send their children to such schools may be influenced in their house purchases by accessibility to their children's school (King 1978:59).

Policymakers in the various Departments of Education have for decades tried to locate schools so that they may be conveniently reached by the children of each suburb, on foot if possible. This fundamental locational rule has not been directly affected by changes in transport, but there have been indirect effects. The reduction in urban density made it possible to be more generous with school grounds and playing fields, but in lightly-settled fringe areas it became harder to
site schools so that they were within walking distance for all children. Again, motorisation made walking and cycling more dangerous, and the reduction in walking distances mentioned in Chapter 2 probably affected school as well as work travel. Accordingly the post-war period saw the increased use of buses for school transport, and in addition many parents began driving their children to school.

In distance terms these problems affected high schools more than primary schools, since high schools have larger catchment areas. In 1970 the average distance from dwellings in Sydney to the nearest public primary school was roughly a kilometre, and to the nearest high school roughly 2 kilometres (Manning 1982). Neither the distance to primary schools nor to high schools varied very much across the urban area, and it must be judged that the New South Wales Education Department had provided its services with equal geographic convenience in all suburbs, even those on the urban fringe. Its efforts in this regard had been assisted by the planning authorities, for during the 1960s it was a commonplace among town planners that a neighbourhood-sized suburb should be defined by a primary school catchment, and thus by children's walking distance.

Until recently the Roman Catholic church tried to ensure that all its members' children were educated in schools run by the church. It therefore provided a school system which duplicated that run by the government. Since the Catholic school system catered to a minority of all children it was to be expected that distances to the nearest Catholic school would be greater than to the nearest public school, though the difference over all Sydney was only about 40 per cent. However, owing to lack of funds the church failed to keep up with the extension of the urban fringe, and by 1970 there was a shortage of Catholic schools in the outer suburbs.

Reflecting the location pattern of schools, the journey to school for most children is brief. School trips are the only kind which are not noticeably longer on the fringe than in the inner suburbs. However, tertiary and technical students and children attending private schools have much longer journeys than average. The children of wealthy parents who are sent to private schools or tertiary institutions are thus the main group to have benefitted from faster transport for their journey to school. For the rest it has been as much a nuisance as a benefit. Falling urban densities and the dangers of traffic have made it harder for town planners and the education authorities to maintain the accessibility of schools, and to ensure the safety of children travelling to and from school.
Health facilities

Most people do not visit the doctor or hospital very often, yet like to have them accessible in time of need. It is also important that hospitals should be located conveniently for visiting. However, for most people the need to be near health facilities is probably not an important determinant of where they shall live, and hence not an important influence over urban layout. Rather their demand has been that the health services be provided equitably to all suburbs, whatever their form or density.

Given that hospitals are government-financed one would expect this demand to have been met, as it was for public schools. However, in Australian cities the state health departments have not been able to exercise strong control over the independent boards of directors which run each hospital. Since the directors of hospitals favour expansion of the existing facilities rather than branching out to serve new areas, the system of decentralised control results paradoxically in centralised hospital services (Donald 1979). In Sydney the distance to the nearest hospital from an average house on the urban fringe was in 1970 four times that from a dwelling in the inner suburbs. On the other hand, studies by Black (1977) and Donald (1979) show that general practitioners were reasonably well-distributed across Sydney. In this case private entrepreneurship came to a better result than the semi-public management of the hospitals.

In view of these location policies it seems likely that journeys to hospital have been lengthening in Australian cities - this being particularly inconvenient for the patients' friends and relatives, who may have to make frequent long journeys to keep in contact. However the explanation has much to do with medical politics and little to do with changing transport technology - except in so far as faster transport has made the locational inertia of hospital facilities a little more bearable.

Recreational facilities

Social/recreational travel is a residual category embracing a wide variety of trips, some of which may influence people's choice of where they live - e.g. they may want to be near, or far, from relatives, or close to the beach or to sporting facilities. Some other kinds of social/recreational trips are generally undertaken too infrequently to influence location (the accessibility of racecourses is not very important when meetings are held no more than monthly) and for other kinds again people appreciate being able to visit a variety of
destinations in turn, in which case local accessibility is not important.

Motor cars were first introduced as recreational vehicles and immediately produced a great widening of their owners' recreational horizons. In Edwardian times excursions to the nearby hills or the beach were major outings; nowadays they can be managed on any day off or even after work. Social ties need no longer be confined to the walking-distance neighbourhood, and sporting competitions can be held on a metropolis-wide basis. Enhanced mobility has made people willing to go to live in new outer suburbs away from relatives and friends and has contributed to the popularity of major recreational events such as League football matches. However, it is by no means apparent that the actual pattern of recreational facilities has been much influenced by transport changes, at least at a local level. We will investigate this for parks, beaches and baths, taking Sydney as an example.

In Sydney parks are largely a local government responsibility though land for new parks is often purchased by the state government through its town planning authorities or dedicated by the developers of new housing estates. The maintenance of parks is more generously funded in the older municipalities (which do not have pressing commitments to road construction) and in upper status areas (which find money easier to raise) (Manning 1973). In its mild way this pattern is similar to that in the USA, where local government services are noticeably better in areas with wealthy residents.

Sydney as a whole is fairly well supplied with parkland, since the average dwelling has 50 hectares within 2 kilometres. However, the distribution of parks favours the upper income areas, and many of the lower status suburbs are short of parkland, particularly larger parks. There is a lack of pronounced differentials between the inner and outer suburbs which seems to indicate that transport history has had little effect on park provision. However, many inner suburban parks were the product of a fitness movement active between the two world wars, and were not original components of the urban design. The lower densities encouraged by motorisation have made it easier to make room for parks in the inner suburbs as well as the outer.

Unlike most facilities, the location of beaches is given, and their accessibility can be improved only by better transport, such as the motor car provides. Much of Sydney's growth has occurred away from the sea, in areas where beaches cannot easily be reached by public transport. Public swimming pools are the obvious substitute, and are provided from
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municipal funds. With an average distance from dwellings of nearly 4 kilometres the public baths are beyond walking distance for the residents of most suburbs, though usually reasonably accessible by bus or cycle. The provision of public pools was a particularly high priority for local governments in the low-status western suburbs, which are far from the sea and where residents could not afford private pools (Manning 1973).

Parks, baths and beaches represent but a small proportion of all recreational facilities, so we cannot claim to have described the effect of motorisation on the accessibility of recreation in general. However, judging by these, it seems that recreational destinations are no more distant in the outer suburbs than in the inner. As with schools, the effect of improved transport and its concomitant reduction in urban densities has been an expansion in the area devoted to parks and recreation, and this has counteracted any car-induced declines in accessibility through the concentration of facilities in bigger units.

Despite the equal accessibility of at least some recreational facilities from the outer suburbs as from the inner, social/recreational trips are on average longer in the outer suburbs. This probably reflects a greater scatter of social destinations, but may also be due to the higher level of motorisation in the outer areas. It is compatible with the conclusion that transport improvements have increased the variety of people's recreational opportunities without reducing the local accessibility of recreational facilities.

Conclusion

The previous three chapters have pursued the benefits of faster transport to the point where they have become hard to quantify and equally hard to debit to particular beneficiaries. The obvious benefit - speed - was not desired of its own accord, but rather because it enabled people to travel further and so carry out their regular activities at places more widely separated in space. Increases in the speed of travel thus presented people with the opportunity to range more widely and choose from a greater variety of possible destinations; they equally provided the opportunity for entrepreneurs, planners and developers to devote more space to each urban activity, while consolidating activities in larger units (bigger schools, larger shopping centres, and so on). The resulting reduction in density and concentration of facilities partly counterbalanced the improvement in accessibility brought about by faster transport. It also meant that anybody without access to faster transport, and whose
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geographic range was thus constant, suffered a decline in the accessibility of jobs and facilities—a point to be elaborated in Chapter 4. It is not immediately apparent that any of these changes—improved accessibility, increased population, lower density and concentrated facilities—is an unalloyed benefit. The most that can be said of them is that they provided conditions under which people might find themselves considerably better off, but equally might not.

When the accessibility of jobs or other facilities is improved people can if they wish reduce the time they spend in travel. Some may do this, but in the long run their general reaction is not to save time but to increase distance, thus availing themselves of a wider choice of possible destinations. Many would claim that the corresponding disbenefit is suburban anonymity: the loss of the sense of community, which again benefits some (those free spirits who feel oppressed in small places) and is bad for others (those who in a small place would find social support which is lacking in mobile societies).

The benefit of a larger population is even more dubious. In so far as it increases the range of facilities available it should contribute towards choice, but this is not very important if the city is already large and its range of facilities considerable (Neutze 1965:Ch 6). As compared with a constant population, growth in numbers either moderates the reduction in density that would otherwise have taken place, or increases the rate of expansion of the urban area, so modifying the increase in the range of choice that comes from greater population.

The benefits of density reductions may be great or small depending on how they are shared out among the different land uses. If they merely go to increase the amount of vacant land within the urban area they are worse than useless. Density reductions may also be a prerequisite of transport improvements: motoring in particular uses considerable amounts of land for roads and car parking. This should be treated as a cost of this form of transport rather than as a benefit. On the other hand, increases in the size of suburban lots, increases in the provision of parkland and in the size of schoolgrounds and increases in the land area devoted to employment when this increases the efficiency of production may all in their way be counted as benefits of lower density. Unfortunately, land use data for Australian cities is not available in such time series form as would allow any judgment to be made on the relative importance of these benefits.

A further possibility when the speed of transport is increased is that facilities may be concentrated without undue
loss of accessibility. Where the fast means of transport is the suburban train, the concentration of activity will occur at the city centre. When, on the other hand, the fast means of transport is the motor car, large facilities can be located at any point in the urban area without undue worry that people will not be able to reach them. At the same time local, small scale facilities can be abandoned. This is most clearly seen in the post-war history of retailing, but is also reflected in the growth of suburban employment centres where large numbers of jobs may be concentrated in places beyond bus travel distance from most of their workers' homes, and way beyond walking distance. Here again there may be a benefit in terms of economic efficiency (manufacturing plants can be built on cheap land; retailers can build large self-service stores and offer lower prices) but in the retailing case the main beneficiaries may have been the big retailers and the main losers the small local shopkeepers.

Both the ultimate benefits and the ultimate beneficiaries of faster transport are thus hard to identify precisely. The introduction of faster transport is one of those major changes which involves alterations to many parts of an economic system, with pervasive side-effects many of which take decades to appear. These changes are the cumulative result of many individual choices, all of which were made without full knowledge of their ramifications. At no stage were people shown a full-scale working model of the city of the future and asked to vote on it - and even if they had, their vote would scarcely have counted, since there is a world of difference between being shown a model and experiencing the reality. At most it may be possible to achieve a political consensus, or at least debate, on the desirable directions of urban change; on the benefits which must be safeguarded (such as the house and garden) and on the costs which should be minimised (such as collision costs). It is simply not possible to quantify the benefits of fundamental change.

It may, however, be contended that it is possible to quantify the benefits from small changes, such as the construction of a new road, which contribute to the fundamental change. Though it may be admitted that the valuation of time savings is an inappropriate method, it could be argued that the benefits are appropriately valued by the toll which motorists would be willing to pay to use the road, whether they were doing so to save time or increase distance travelled. This suggestion has practical difficulties - people may not be able to name the notional toll, and may not be honest about doing so. Yet even if they give an honest and accurate response they
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cannot take into account the locational changes which may result from their travelling further, so such an assessment of benefit is only a first approximation — accurate enough, perhaps, if the new road is but a small change in an urban system which is not otherwise changing much, but liable to be a serious misestimate if the new road is part of a continuing process of change. In these circumstances, therefore, it seems that particular investments should be seen in the context of a total strategy of urban change, and assessed for their compatibility with that strategy, and not for their individual benefits.

When benefits are hard to evaluate, it is likely that costs will be also. In Chapter 1 we listed those costs on which individual transport choices were based — the private cash costs of fares, car purchase and operating expenses. These are not the only costs of transport. We must therefore balance our account of the benefits of speed with a further exploration of its costs.
The public costs of speed

This book began with the record of two major changes in urban passenger transport: the switch from walking the whole of any journey to using public transport for part of most trips, and the subsequent forsaking of public transport in favour of private motoring. These changes were explained in Chapter 1 in terms of a demand for speed, whose fulfilment became possible as incomes rose and the relative price of fast transport fell. The assumption was that individuals balanced the gains from speed against their cost, the costs being chiefly the cash cost of fares in the case of public transport, and various capital and running charges in the case of motoring.

For individuals as they made their choice of faster transport the chief attraction of speed was the increased journeying range - though some may also have been lured by the promise of time savings. In its turn the increased travelling range made previously distant urban facilities accessible, and enabled many families to shift to new houses in the spacious outer suburbs. However, once most of the residents of a city had adopted faster transport the layout of the urban area was modified, so that the collective benefits of speed differed from those which individuals expected to gain when they made their choice. These benefits were that cities could house larger populations at lower densities, with activities concentrated in large-scale centres - big factories instead of small workshops, large supermarkets instead of mum and dad shops. The benefits of speed for individuals were largely in terms of increased accessibility and the possibility of outer suburban living, but in the aggregate these were to a considerable extent traded off against increases in population and increases in the concentration of activities. The benefits of the widespread adoption of faster transport thus diverged considerably from those influencing individual choices. Can the same be said of the costs?

The short answer is yes. The private costs of fast
transport – the fares and the package of motoring charges – do not directly include the whole cost of the provision of the transport service. In the case of public transport we have already charted the onset of subsidies (Chapter 1), though we have not considered the arguments as to why they should be paid or withheld. It remains to ask to what extent the costs of motoring are understated in the payments made by motorists. Fortunately a great deal of work has been done in this area and it will not be necessary to dwell on the divergences between private and true social costs. Each will be accorded a few paragraphs in the following order:

1. the costs of road construction and maintenance (balanced by taxes on motorists);
2. collision costs;
3. environmental costs;
4. the possibility that petrol is underpriced, and
5. the problems of people who do not have access to cars.

Public expenditure on motoring

Until the recent emergence of subsidies, the railways and tramways recouped their entire costs from fare revenue, including the cost of the tracks on which they ran. The revenue from any particular service could therefore be balanced, not only against vehicle operating costs, but against track maintenance and construction costs as well. Buses likewise covered their expenses from revenue, though it was uncertain whether their contributions to road maintenance exactly covered the roadbuilding costs they occasioned. In this they were at one with road users in general, since, apart from a few tollways, no attempt is made to charge directly for the use of particular stretches of road. Instead, roads are a charge against the consolidated revenue of all levels of government. In the 1970s spending on roads absorbed approximately 2 per cent of the total outlay of the Commonwealth of Australia, between 5 and 6 per cent of the spending of the combined states (more than half of this being financed by Commonwealth grants) and about a third of local government expenditure (Manning 1983: Ch 7). Overall, roads absorbed about 4 per cent of the outlays of all Australian governments combined. By contrast, apart from some Commonwealth contribution towards capital costs, urban public
transport was a charge only on the state budgets. In New South Wales in 1977-78 it absorbed approximately 6 per cent of total state expenditure from taxes and grants.

The motoring organisations are never slow to point out that public expenditure on roads is balanced by taxes on motorists. This claim has led to a sterile debate between those who believe that motoring taxes should be paid into a special fund for spending on projects of benefit to motorists, and those who support the existing procedure by which the taxes on motoring are paid into consolidated revenue and spending on roads is decided in relation to government priorities as a whole (Manning 1983:Ch 4). This consolidated revenue view is held by both the Commonwealth and state treasuries as part of their general opposition to tied taxes. (They argue that the excise on tobacco should not be reserved for the benefit of smokers; likewise the excise on alcohol should not be reserved for drinkers; therefore the petrol tax need not be reserved for motorists.) The debate about road money is as old as the motor car, as is the practice by the Commonwealth of spending less on roads than it raises in petrol tax, crude oil levy, and sales tax on cars. On the other hand it must be remembered that local government spends a great deal of money on roads which it raises from non-motorist sources, chiefly the local property rate.

Even though the argument as to whether revenue from motorists equals spending to their benefit is of little importance in day to day administration, it must be met head-on when the relative levels of subsidy to different transport modes are being considered. Economists who believe in the efficiency of private markets as means of allocating resources are particularly concerned that each mode of transport should pay its way, and hence want to know whether the amount raised from motorists covers the public costs they occasion (Roth 1967). Unfortunately there is disagreement as to the revenues and costs which should be balanced in this calculation, but, with differences either way due to inclusions and omissions, most economists in the mid 1970s agreed that revenue from motor transport in Australia was roughly equal to expenditure on roads and ancillary services such as lighting and police. In this balance, private urban motorists were probably paying more than their share of costs, and so cross-subsidising heavy trucks and rural motorists.

Such a comparison of current revenue and expenditure is, however, not exactly what is demanded by the market test of resource allocation (Neutze 1978:131). It makes insufficient allowance for the capital tied up in the road system. No
private business is content that its current revenue should equal current expenditure; it wants a return on its capital as well. An alternative valuation of the cost of roads involves assessing the capital value of the road system and converting it to a current cost by applying an appropriate rate of interest (Ravallion 1974). In urban areas approximately 80 per cent of the capital value of the roads system lies in the value of the land. As a rough calculation, sufficient only to give an order of magnitude, if the motorists of Sydney were required to pay a 15 per cent dividend on the value of the metropolitan road system the cost of motoring in cents per kilometre would approximately double.

This calculation is not made as a serious policy suggestion, but rather to point out that the full costs of motoring can be very high indeed where valuable land is reserved for roads and car parks. Compared with walking and public transport, motoring is a voracious consumer of land. This does not matter in the country, where land is cheap, but becomes of the utmost concern in cities, where the motorists' demand that they be provided with congestion-free roads and free parking space has led public authorities into impossible commitments. Most of the land at present used for urban roads was dedicated by surveyors in the early days of the Australian colonies, or else was donated by developers as a condition of permission to subdivide. When an attempt is made to insert a new road into an area already built-up more land has to be bought, often from unwilling sellers who are loathe to move their homes and businesses. It is only then that the full cost of roads is brought home to the roadbuilders.

In inflationary times it is easy to underestimate the land cost of a new freeway - the land has to be bought first, and engineering tasks undertaken second, so that in current dollars the latter are exaggerated. Correcting for this it can be calculated that land acquisition accounted for nearly two-thirds of the total cost of the inner part of the Warringah Expressway in Sydney. In millions of dollars per kilometre built, the Warringah Expressway was about twenty times as expensive as the Bulli Pass Tollway on the southern outskirts of Sydney, a freeway that itself involved substantial engineering works though no land resumption (Manning 1978:173). Cost is a major deterrent to roadbuilding in the inner parts of Australian cities.

Despite this deterrent, road spending in Australia in the late 1960s and through the 1970s increasingly emphasised urban roads. Correcting for inflation, the rate of spending on urban roads by the three levels of government combined doubled
between 1965 and 1977 (Burke 1977; Manning 1983).

It is only in the case of Sydney that road spending can be traced back before 1965: in the other cities metropolitan spending was not distinguished from country in the accounts of the road authorities. Table 4.1 presents the history of spending deflated by the consumer price index, not because that index is specially appropriate but because it is handy. It can be seen that road spending was quite low in Edwardian times—and much of that low level was incurred by the tramways specifically to improve the roads for public transport. However, increasing car ownership in the 1920s brought forth a demand for better roads, and the public authorities responded. Roadbuilding expenses in Sydney were further increased by spending on the Harbour Bridge. After a fall during the depression roadbuilding recovered in the late 1930s, till it was running at the same level as it had been a decade earlier, apart from the Harbour Bridge. It was trimmed during the Second World War, and then recovered slowly, for in the 1950s all levels of government gave priority to rural roads. Gradually during the 1960s the state government switched resources towards urban roads, and in 1969 the Commonwealth followed suit by changing the formula for its grants. Since then a great deal of money has been spent on roads in the metropolitan area, though the amount spent per vehicle on the register has increased but slowly if at all (Table 4.2).

Table 4.1 Road expenditure, Sydney

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<td>1918</td>
<td>1.9</td>
<td>1.3</td>
</tr>
<tr>
<td>1928</td>
<td>11.6</td>
<td>7.0</td>
</tr>
<tr>
<td>1938</td>
<td>8.1</td>
<td>5.4</td>
</tr>
<tr>
<td>1948</td>
<td>8.4</td>
<td>3.9</td>
</tr>
<tr>
<td>1958</td>
<td>32.4</td>
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<tr>
<td>1968-69</td>
<td>87.0</td>
<td>15.7</td>
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<tr>
<td>1969-70</td>
<td>109.0</td>
<td>19.0</td>
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<td>1974</td>
<td>183.0</td>
<td>22.1</td>
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Public spending on roads thus ran parallel to the increase in car ownership. However, funds were not sufficient to rebuild the roads in the inner and middle suburbs to the full motoring standards reached in the outer suburbs and generally in the cities of North America. From the motorists' point of view roads in the inner suburbs were still excessively subject to congestion and slow travel speeds, while from a pedestrian's or resident's viewpoint most roads and streets in the inner suburbs were carrying far more than their designed load of traffic. The costs of rebuilding the older suburbs to take the full onslaught of motor traffic had proved prohibitive. Two policy innovations of the 1970s must be understood against this background. The first, public transport subsidies attempted to maintain the price advantage of public transport in recognition that it still had a cost advantage in areas where land is scarce once full public costs are taken into account. The second innovation was schemes of traffic restraint, beginning with street closures and transit lanes, and possibly (as already in Singapore) moving on to the general restraint of traffic in inner areas by restrictive licensing or other means (Thomson 1977:Ch 7).

Collision costs

Because of the nature of motor transport, with vehicles steered on the open road by amateur drivers, it is inevitable that there will be occasional collisions. From time to time people accelerate or brake when they should not. They steer wrongly once in a while; cars become the vehicles of emotion or merely the chariots of sleepiness or stupor. Considering the potential for damage that lies in a ton and a half of assorted metals travelling at 60 kilometres an hour the wonder is that there are so few smashes, yet collisions are still a real risk and most people rate the lack of safety as the most unsatisfactory aspect of road transport (CBR 1975:58).
In the mid 1960s the typical Australian car was colliding with something or somebody about once every five years, or every hundred thousand kilometres driven - a merciful and significant reduction from the rate in the earlier days of motoring (Troy and Butlin 1971). The great majority of these collisions were minor affairs in which nobody was hurt. The typical prang cost a few hundred dollars in panelbeating charges. However, in a minority of collisions the damage was much greater, with vehicles written-off and people put into hospital. Even leaving aside the costs of death and injury, damage to vehicles in collisions added substantially to the expense of motoring, the addition being roughly half as much again as the cost of petrol.

When people worry about road safety they are usually more concerned about the possibility of death or injury than of damage to their cars. In 1975, 3,700 people were killed on the roads in Australia, and 90,000 people were injured (ABS Year Book, 1976). These figures seem large, but must be seen in perspective. At current road toll rates, only a little over one in 50 of all babies born in Australia will meet its death on the roads. By this measure, collisions rank way behind cancer and heart disease as cause for concern. On the other hand, roughly half the children born can expect to be injured on the roads at some stage during their lifetime. Though many of these injuries will not be serious, collisions have a nasty capacity to make people into quadriplegics and otherwise permanently damage the brain or body.

The dangers of driving afflict men more than women - the male death rate from collisions is nearly three times that of women - and affect young people more severely than old. Of those admittedly few Australians who die in their twenties more than half lose their lives on the road. The fact that only one person in 50 dies in a motor collision thus understates the significance of collisions as a cause of death. Men do not live for ever, but may rather hope to survive for three score years and ten. Judging by the total number of years of life taken away (the number of deaths multiplied by the years of life each person had to go before reaching retiring age) collisions rank third among all causes of death, after heart disease and cancer.

Public concern about the road toll has had its effects, and improvements in road and vehicle design and in the way people drive have reduced the incidence of injuries, and more particularly deaths, per car kilometre driven. In the mid 1960s there were roughly 150 injury collisions a year for every 10,000 motor vehicles on register, but over the next decade the
annual total came down to about 100. Over the same period the kilometreage driven annually in the average car increased a little, so it can be claimed that the safety record of motoring as a means of travel improved markedly. On the other hand, the rising total number of cars on register counterbalanced the improving safety record of each individual motorist, so that the chances of dying or being injured on the roads stayed roughly constant. Most of the people killed or injured were travelling by car, but a minority were pedestrians and cyclists.

The likelihood of injury to pedestrians was greatest for children of primary school age and for old people (Gilmour 1978:173). The motor car has replaced the marauding wild beast as the danger from which children must be shielded, given their notorious lack of road sense. On the other hand, the relatively high injury rate among elderly pedestrians is doubtless due to their declining agility rather than to any lack of respect for the motor car. There are many stories of elderly people who are so frightened of modern motor traffic that they limit their walking to avoid it. Even if they have not fear but merely respect, the streams of traffic on many suburban roads, which make them difficult enough to cross even for the young and agile, may turn them into impassable barriers for those whose walking speed is slow.

The blame for road injuries involving pedestrians has never been sheeted home. Motorists have always claimed that the great majority of pedestrian injuries and deaths were the fault of the pedestrian himself, for walking on the road without taking due care. The pedestrians in their turn blame the excessive speed of motorists, pointing out that in the days of horse-drawn traffic very few people were killed on the roads. This was the force behind the unsuccessful attempts by Edwardian parliamentarians to have motorists limited to the same speed as horse-drawn traffic (Manning 1983:Ch 4). They failed because nobody could be allowed to stand in the way of technical progress, yet their failure committed many thousands of unknown people to death.

Because of their size buses and trams protect their passengers from injury reasonably well in the event of a collision. This also applies to trains, which, unlike road transport, obey an elaborate safeworking system designed to prevent collisions. When this breaks down the railways are capable of producing collisions of disaster proportions, but overall their safety record is far better than that of their road competitors (Gilmour 1978:Ch 8).

Despite differences in safety between the means of
THE PUBLIC COSTS OF SPEED

transport, the probability of death or injury occurring on any particular trip is negligible, and unlikely to affect individuals as they choose whether to walk, ride a bicycle or bus or go by car. On the other hand, collision costs are high enough to warrant careful political attention, and to affect decisions about the way transport is to be administered.

Because the victims of collisions are readily identifiable some attempt is usually made to compensate them financially for their injury, generally through the courts and the third-party insurance system. The compensation paid is haphazard, with major differences of outcome resulting from minor differences in relative negligence. There is no doubt that compensation arrangements could be improved - particularly if the legal costs currently incurred in settling compensation claims could be reduced. Yet even at its best, financial compensation is a rough and ready measure. Posthumous financial benefits are no great comfort to those killed in collisions, while payments for damages may or may not lighten the burden of those crippled for life. In such cases certain individuals are by misfortune selected to pay far more than their fair share of the costs of fast transport.

Environmental costs

The environmental costs of transport, particularly motor cars and trucks, have been a matter of increasing concern in recent years. None of these environmental costs can be easily evaluated, but their seriousness shows through in political behaviour. There has been a demand for emission control to reduce the amount of air pollution (visible and invisible) caused by motor traffic, and similarly attempts have been made to place decibel limits on cars and (with greater difficulty) on trucks and motor cycles. On another front, local governments in the inner areas of Australian cities have been under pressure to remove through traffic from residential and shopping streets, generally by street closure or by the declaration of shopping malls. In some places particular annoyance has been caused by heavy trucks, for example those carrying export coal through the streets of Newcastle and Wollongong, NSW, and efforts have been made to have this traffic diverted to other ports or to the railways (McCalden and Jarvie 1977). There are always counter-arguments: trucks provide employment and streets are needed for the residents' own cars. Though the suggestion was first made in the economics literature in the 1950s there have so far been no demands for the complete banning of motor cars from whole suburbs. However, the existence of counter arguments does not
deny the reality of the environmental problems caused by motor traffic in areas not designed to take it.

The opposition to road traffic on environmental grounds is strongest in the inner suburbs, where roads designed for horse traffic are being forced to carry heavy loads of motor vehicles. It is often suggested that this problem could be alleviated by building new transport routes through the inner suburbs, either freeways or (more recently) reserved-track public transport routes. However these suggestions have encountered as much, if not more, opposition from inner area residents as the present traffic pattern. (In the mid-1970s it may have been thought that this opposition was reserved for freeways, but inner suburban opposition to the proposed light rapid transit route, later busway, to the North East Suburbs of Adelaide was as intense as the opposition to any freeway.) If the inner suburban residents win their case, and impose a reduction in traffic capacity through their areas, the natural result will be further decentralisation of economic activity from the centre of the city to the outer suburbs, strengthening the trends noted in Chapter 3. If this happens the inner suburbs will lose some of their advantage of accessibility, since being close to the city centre is less important if that centre is in decline. However it may be that the accessibility advantages of the inner areas are so considerable that their residents would willingly trade a decline in accessibility for an improvement in environmental quality. Indeed, it has been argued that the decentralisation of activity away from the inner areas has been in part a response to environmental deterioration due to traffic, and that traffic limitation is therefore likely to arrest the potential economic decline of the inner areas. Similarly it is arguable that the existing roads, subjected to a scheme of traffic restraint favouring buses, could carry all the people needing to travel within the inner suburbs at higher environmental standards than now.

Petrol prices

In the years after the Second World War there was much public discussion in Australia questioning the wisdom of basing the country's transport system on imported fuel. However as memories of the war receded, and as supplies of that fuel continued to arrive at prices which were falling rapidly in real terms, these concerns were forgotten, only to be revived by the rises in the price of oil in 1973 and 1978. During the 1970s various frightening calculations were made involving world reserves of oil and accelerating depletion rates, and it was argued that insufficient attempt was being made to conserve
supplies of this diminishing resource for future generations. In other words, petrol was underpriced, and the costs of motoring had been understated (Conservation of Urban Energy Group 1978: Ch 1).

Despite wild predictions that people would soon have to return to walking and to fuel-efficient public transport, the actual increase in the cost of the standard motoring package when Australia adopted the increased international oil price as the basis of the domestic price of petrol was hardly noticeable in the general inflation. Being of the order of 10 per cent or so, it was enough to persuade many people to buy smaller cars, and possibly enough to halt or at least slow down the gradual diffusion of cars among segments of the population which did not already have them, but was not enough to bring about any noticeable decline in car usage in urban areas (Brain and Schuyers 1981: Ch 10).

Though the increase in oil prices had little effect by the time it had filtered through to the private motorist, its effect on international fiscal flows was considerable, and it brought balance of payments problems to many countries. The rise in the price of oil, and the reluctance to cut consumption of it, was thus a factor in bringing the post-war boom to an end in the Western World generally. The resultant reduction in the rate of growth of incomes was a major factor in the failure of the demand for oil to keep on growing as predicted, and hence in the adjustment of demand to supply at the new higher price. In addition, the higher price prompted a switch from oil to coal for industrial use, and made it profitable to produce oil from difficult oilfields like the North Sea, so further curtailing demand and adding to supply. However it remains to be seen whether this balance can be maintained in the event of resumption in oil-using economic growth in Western countries or (more important) in the many Third World countries where the use of motor transport is still very limited. Should the Indians or Chinese start to consume petrol at the American rate there really will be a shortage.

The threat of an immediate petrol shortage may have receded, but the causes for long-run concern have not gone away. Petrol (or something very similar) remains the only acceptable fuel for motor vehicles, since the investigation of alternatives prompted by the energy crisis has not come up with a substitute even at a much enhanced price. Again, the threat remains that the atmosphere will not be able to absorb the products of burning fossil fuels without climatic change. It is still, therefore, arguable that widespread motoring in the rich countries is in one way or another storing up trouble for the
future, and hence that motoring is underpriced.

The problems of people who do not have access to cars

Even if the price of fast transport reflected allowances for all the extra costs we have so far enumerated, and even if compensation were paid in full to all those adversely affected by collisions and environmental damage, the evidence of Chapter 3 is that there would still be people adversely affected by motoring. The reason is that the changes in urban layout which result from the adoption of fast transport disadvantage people who cannot use the new fast methods of travel, as well as those who can but do not want to.

According to the most conservative tradition in economics, an economic change is only unambiguously worthwhile if it makes some people better-off without worsening the position of any others. If a change is made which contravenes this principle, those whose position is worsened may justly claim that they are bearing some of the costs of those whose position is improved, and may therefore claim compensation from them. In the case of the move from walking to public transport few were unambiguously badly affected. (Wives who moved to the then outer suburbs with their families might have found shopping less convenient, but they simultaneously benefited from better houses in more spacious grounds.) On the other hand, in the case of motorisation, non-motorists could claim that their mobility was circumscribed by worsening public transport services and by the rebuilding of the city so that facilities were accessible conveniently only by car.

A more radical version of the argument adopts a different criterion for assessing economic change. It considers change desirable if it benefits disadvantaged groups relatively more than others. From this standpoint the argument against motoring becomes stronger to the extent that non-motorists belong to disadvantaged groups. They tend to have low incomes and also to be handicapped in other ways. This being so, both the conservative criterion (compensation for those made worse off by economic change) and its mildly left counterpart (redistribution towards the disadvantaged) argue that there should be a transfer of resources away from motorists towards the provision of minimum levels of mobility for non-motorists.

One of the main disadvantages of the motor car as a 'universal' means of transport is that not everybody can drive. Non-drivers cannot take advantage of the speed of motoring unless they can find chauffeurs, usually from within the family. While there are people whose lameness prevents them from walking but not from driving, and who have thus benefited
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greatly from motoring, their numbers would be less than those unable to drive, which include all children under driving age and perhaps 20 per cent of the adult population.

Adults may be debarred from holding a driver's licence either because they do not pass their theoretical or practical tests or because they break the road rules and have their licences withdrawn. A proportion of licensed drivers, estimated at about 6 per cent, is continually in trouble with the law for drunken driving and other offences (Kornaczewski 1972; Raymond 1972). Around 1 per cent of the licences on issue at any time are cancelled each year by courts of petty sessions (Bureau of Crime Statistics 1973). In administering these provisions the courts carry on the running battle that started between motorists and the police in the very early days of motoring, constantly balancing the general demand for severity in the interests of road safety against claims for leniency in particular cases.

The proportion of the adult population unable to drive due to disability is much harder to estimate. The best estimate is probably the proportion of the population of licensable age not holding a licence, adjusted downwards by a guess as to the proportion not holding a licence because for financial reasons they do not have access to a car. Financial reasons help to explain the lower proportion of licence-holders in the lower income groups, and the lower proportion among women than among men (Davis 1975). The rate of licence-holding also declines with age, due to a combination of present low income, lower incomes in the past (meaning that when today's elderly people were of an age to learn to drive there were fewer cars around) and current disability. Among Adelaide residents in 1976 the highest rate of licence-holding was among men in their thirties: only about 3 per cent were not licensed, falling to two-thirds unlicensed for all adults over 65 (Morris 1981:28).

The seriousness of the inability to drive among adults depends on the extent to which a person wants to travel, and on the availability of chauffeurs. Many disabilities which debar driving also reduce or extinguish the desire to travel. The inability to drive does not circumscribe an elderly person who has no desire to go out. Similarly many people who cannot drive are hindered in walking or using public transport. According to a survey conducted in Adelaide in 1976 the proportion of the population prevented by handicap from travelling by bus was not much less than the proportion prevented from travelling by car, though the survey was not specific about whether this meant unable to drive or unable to ride. Even so, many people who cannot drive due to such
THE PUBLIC COSTS OF SPEED

conditions as bad eyesight, or due to loss of their licence, desire to travel just as much as other people of similar age. Some non-drivers may be able to rely on their spouses, at least for recreational travel, while if both work they may be able to arrange their workplaces so that one can drive the other. On the other hand, the husband or wife who cannot drive will find that this limits his/her independence, and also his/her children's mobility, for they have one less potential chauffeur. The inability to drive is even more of a restriction when there is no driver in the family.

Society may consider that it has provided sufficient mobility for children if it ensures that they get to and from school, but the adult non-driver is much more of an embarrassment in an age of 'universal' motoring. In all except the most densely populated cities such people are too few in number to justify a general public transport service on their own. It is ironic that the universal adoption of a means of transport designed to increase autonomy and freedom should turn out to increase the dependence of a significant proportion of the population, both adults and children. It is also ironic that the claims of these dependants should require other people to pay for their autonomy by driving long miles of (in the jargon) 'serve passenger' trips (Shaefifer and Sclar 1975:107). In 1975 such travel was responsible for approximately 7 per cent of all car mileage in Melbourne (Lawlor 1978:46).

In addition to those who are legally debarred from driving a significant proportion of the adult population, even nowadays, cannot afford to drive. The potential size of this group may be calculated by taking the minimum cost of the standard motoring package (defined in Chapter 1) and seeing how it fits into household budgets. At most income levels it can be afforded with undue strain, in the sense that it absorbs no more than (say) 22 per cent of the household budget. (The average amount spent on transport, including fares and second cars, was 18 per cent of the total expenditure of all households in 1975-76.) However when the total budget is constricted by low income the cost of motoring becomes expensive. Around 20 per cent of Australian households have incomes below or not much above the poverty line, and a majority of such households have no car.

Over and above those households which cannot afford a car at all, many households can afford only one, yet contain more than one licensed driver. It is not always possible to arrange the affairs of such households so that the one car suffices for all their members to travel when and where they want (Faulkner 1978). 'The high incidence of lone car use for the journey to
work suggests that one-car households are effectively no-car households during the working week.' (Morris 1981:29).

The disadvantages of those who have no car for financial reasons yet live in a motorised society are similar to those of people who are legally barred from driving. However, it has been suggested that the number of households which are careless for financial reasons will diminish as the cost of motoring continues to fall relative to incomes - even pension incomes. Poor people in the United States generally have cars.

What, finally, of the position of those households whose members could drive, and could afford to in the sense that the cost of the standard motoring package would not take up more than the conventional 22 per cent or so of their household budgets, yet who prefer not to? They may complain that the rebuilding of the cities in a way that does not suit their relatively unusual tastes has disadvantaged them. On the other hand such people usually prefer to live in the redeveloped inner suburbs, close to the bright lights. They should reflect that motorisation has taken a great deal of pressure off the inner suburbs by making it easier for people to live in the outer areas. That same traffic which has blighted many inner suburban streets has assisted in the conversion of the inner suburbs from high-density residential areas, with each house occupied by several families, to their present gentrified state.

What can be done about the disadvantages of fast transport?

In the preceding five sections we have argued that the price of motoring on which people based their decision to become motorists was and still is mis-stated, and that the mis-statement is on balance an understatement. However it was difficult to say by how much. It was hard to put a value on the total cost sustained by those whose environment was adversely affected by motoring, or on the possible injury done to future generations by the present-day failure to conserve liquid fuels, or on the loss of accessibility by non-motorists as cities have gradually adjusted to the motor car. Even if the total costs were capable of estimate, it was difficult to divide them up among the injured parties. Similarly, the unpaid costs caused by some motorists were much more than those occasioned by others, according to when, where and how they drove. Thus some were subsidised by the financial arrangements covering roadmaking, and some were not. Some contributed greatly to collision costs, and some did not; some occasioned heavy environmental costs, and some did not.

Though it may be agreed that those who are causing the
trouble should compensate the injured (always leaving aside the insoluble problem of compensating the dead) these difficulties of valuation mean that a system of surcharges on motoring, the revenue being used to compensate injured parties, would not be workable in all instances. Even so, such a system is in part operating already to compensate for collision damage, and could be extended and improved. Again, if it is desired to conserve petrol the simple way to do it would be to raise the price—remembering that this would bear more heavily on low-income motorists than high, and so be in conflict with the principle that it is worse to injure the poor than the rich. In a general sort of way it would also be fair to use some revenue from motorists to subsidise a minimum level of mobility for those who cannot drive, though what level of transfer is justified is hard to calculate. Finally, despite the best efforts of economists for many years, no way has been found to impose prices on road use according to the roadmaking costs and environmental costs occasioned by journeys at particular times along particular stretches of road (Thomson 1977:Ch 2).

In these circumstances, where costs are being imposed but in a way which is hard to evaluate, it is best to proceed, not by proposing a set of charges but in terms of minimum standards. Minimum standards of air quality can be set, and met either by emission controls or by limiting the amount of traffic allowed to use particular streets or to enter restricted parts of the city. Minimum standards of accessibility by non-car transport can be set for urban areas, and maintained by a combination of town planning (ensuring that destinations are within reach) and minimum standards of public transport. Minimum standards of road safety can also be set, and incorporated into schemes of traffic management, and into the administration of driver's licensing. Finally, traffic management and restraint can be effective in limiting traffic at times and in places where it would be costly to service, especially in the long run where it can be coupled with town planning policies on the location of facilities. The existence of numerous uncompensated costs of motor traffic need not therefore lead to an unsophisticated attempt to increase motoring costs overall (except to conserve petrol) but should rather prompt an examination of the law regarding motoring, and of the administrative practices that govern the use of the streets. Much of present practice is due to historic accident, and is overdue for reassessment.

Yet none of these assessments of cost meet the fundamental proposition of Chapter 3 which is that, when all the side effects are taken into account, our forefathers who elected to switch to fast transport gained and lost in ways quite
different from those they thought they were gaining or losing. They cannot be said to have chosen with full knowledge, and we who inherit the results of their decisions cannot be said to have made a free choice of our inheritance. We are therefore morally free to make what assessment we like of it; but not practically free, for cities can only be changed slowly. Rather, therefore, than conclude this book with some Olympian but pretentious balancing of the costs and benefits of speed, we turn to a much more practical and interesting question: what is likely to happen should we lose the speed we have gained?
The loss of speed

With the spread of car ownership to most families, the process of speeding-up urban transport has been completed. It is therefore a good time to assess the costs and benefits of faster transport, remembering that none of us, nor even our forefathers, deliberately chose to bear these costs for the sake of these benefits (for both costs and benefits were only partially known to those who chose them). Yet even though we are under no obligation to believe that the present situation was chosen as the best possible, there is little point in dwelling on what might have been: how the costs might have been less with better pricing mechanisms, or the benefits greater with improved town planning. Rather, we should look to the future and ask where we go from here.

This final chapter accordingly begins with a short assessment of the likelihood of continued gains in speed, and concludes that further gains are unlikely. Indeed the troubles of the future are not likely to be those of continued adjustment to faster transport, but those occasioned when people lose the fast transport to which they have been accustomed. Even though the general threat of a fuel shortage has receded for the time being, individuals will continue to be affected by the withdrawal of public transport services, or the loss of their driving licences or of the use of their cars. The chapter accordingly assesses the benefits of speed in terms of what is lost when people can no longer travel quickly, and asks what can be done to minimise these losses.

Future improvements in transport technology

From the users' point of view the history of urban passenger transport over the past century has been a succession or perhaps accumulation of technologies, of which no less than five remain in current use: walking, cycling, on-street public transport, trains and motor cars. A sixth, horse-drawn private vehicles, disappeared with the introduction of the motor car. Each technology has its distinctive road speed and typical
walk/wait time, and these have been remarkably constant since it was first introduced. Basically this constancy reflects the nature of technology. Large increases in speed may be achieved when mechanical power is first applied to a means of transport but once this has been done further increases are very hard to bring about. Even so, there are still optimists who look forward to a continuing sequence of technical improvements. The direction of such improvements is hard to foresee, since now that both public and private transport have been mechanised there is little scope for spectacular gains in speed. To achieve a further quantum jump in urban transport speed would require the adoption of such devices as personal helicopters, and these can be rejected on grounds of fuel cost, noise, danger and potential invasion of domestic privacy. Serious suggestions for transport improvements are much more modest, and can be classed into two groups: suggestions for increased vehicular speeds and suggestions for new technologies which would replace or supplement the motor car with no great increase in speed but with reductions in at least some of the costs it occasions.

The main hope for increases in motor car speeds comes from road construction and traffic management. It is a limited hope.

Road construction in its most spectacular form concentrates on building freeways. At their best freeways can provide fast and relatively safe driving for long-distance traffic - the spacing of entrances and exits has to be such that freeways are generally of no use for journeys of less than average length (8 kilometres for a car journey in Sydney). However, the actual increase in speed which results from the opening of a new freeway depends on the extent to which the new road generates extra traffic. It is quite possible for traffic increases to nullify the gains in speed, if not through congestion on the freeway itself, then at least through traffic jams near the entrances and exits. To guarantee an increase in speeds even for the long-distance minority of total motor traffic it would therefore be necessary to engage in a program of freeway construction of such magnitude that all traffic offering can be carried. In an era of limited investible funds this is too expensive; and the environmental costs are also too great.

Traffic management, even if it is viewed as the art of squeezing maximum capacity out of the existing street layout, is generally hard put to maintain speeds in the face of traffic increases, let alone raise them. This is true even when management techniques are accompanied by small construction works, such as those aimed at increasing the capacity of
THE LOSS OF SPEED

junctions. Again, particular traffic streams are often sped-up at the expense of others, as when stop signs are erected and turns prohibited. Even when unequivocally directed towards maximising traffic flow, therefore, traffic management offers but an uncertain promise that congestion can be reduced and increasing numbers of vehicles handled at faster speeds. Further, its aims are gradually changing. The danger, noise and pollution costs of motoring have given rise to demands that traffic be controlled in the interests of pedestrians, cyclists and residents as well as motorists. If this demand increases in strength it is quite likely that some traffic management measures in the future will reduce street capacity, and so cause increased congestion.

Neither freeway construction nor traffic management are likely to bring about major increases in road capacity. The future trend of car speeds will therefore depend mainly on the level of congestion, which in turn will depend on the growth of traffic. Until recently traffic growth has been one of the certainties of economic life, but with reduced rates of population and economic growth this can no longer be taken for granted. If the rate of growth of traffic moderates it may turn out that enough spare capacity exists in the road system in most urban areas at most times of day for the growth to be accommodated with no great reduction in speed, while in yet other areas minor construction and traffic management may succeed in maintaining speeds. Even if speeds do decline it is observed that slower speeds discourage traffic, and that before the regular traffic on any road grinds to a halt the demand falls to a level within the slow-speed capacity of the road. Severe congestion remains severe, but it does not worsen any further. There is thus a lower limit to car speeds, and in areas currently suffering from severe congestion speeds are unlikely to fall further. In summary, the outlook for car speeds is that they should remain similar to the present in most areas at most times of day, but subject to slow decline should traffic continue to grow.

Suggestions for increasing train speeds generally involve new rolling stock which consumes more electric power, new signalling and track, and more expresses. Such measures are costly, but can be effective in increasing speeds for the longer rail journeys. On the other hand, they do nothing to reduce the long walk-wait times which are the chief drawback of suburban train travel. Similarly measures to increase bus speeds (reserved lanes for buses, more express running) tend to assist only for the longer journeys. Faster bus speeds are most readily achieved by cutting down on stops, which tends to
increase walking distances. It is possible by this means to provide railway-type service with buses, especially where the buses run on a reserved roadway free from congestion. In some areas this may be the cheapest way to provide fast long-distance public transport, but it offers no solution to the problem of the slow speed of local buses and trams. In other words, some speeding of public transport vehicles may be possible particularly on the longer distance routes, but none of these measures offer very much in the way of reduced overall journey times.

A second group of technological suggestions would try to conserve the advantages of the motor car while minimising its drawbacks. We have already seen that motoring in urban areas is a costly means of transport. Its private cash costs amount to around 17 per cent of the typical Australian household budget, while the public cash costs are also significant, especially when attempts are made to increase road capacity in areas already built-up. Further, motoring is dangerous, noisy and polluting, and denies mobility to non-drivers. To get around these disadvantages engineers have dreamed of electric dodgem cars running at high speeds on special rights of way which would be far less prodigal of land than freeways (Loder 1974). These computer-controlled capsules would be as easy to drive as automatic lifts, and would provide personal transport for all citizens with complete safety. However, their capital cost is likely to be so high that practical men do not even consider it worthwhile building trial installations, and in any case they offer no great increase in speed over the present-day motor car (Ogden 1974).

At a more humdrum level there have been suggestions that public transport could be made more competitive with motoring by eliminating walk/wait time, using buses which would call at people's houses on demand. This was tried out in various 'dial a bus' experiments, and it was found that if costs were to be kept anywhere near the costs of conventional bus services people would have to wait (Usher 1978). The only near-substitute for the private car is the taxi, which is inevitably expensive (the driver's wages are spread over at most a small number of passengers) and even then does not completely eliminate the problem of waiting time (Rathery 1979).

The future, therefore, offers little in the way of exciting transport innovations. We are left with motoring as the fastest transport mode. There is no innovation by which public transport is likely to be revitalised to the point where its speed equals that of cars. About the only means of transport for which the future seems to offer definite improvements are
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walking and cycling. In many suburbs over the past few decades much of the pleasure has been taken out of walking and cycling by the increase in motor traffic, but there are now signs that local politicians are trying to make amends by declaring pedestrian malls and building cycle paths. Any future reductions in motor traffic brought about by regulation or by fuel shortages will further improve conditions for pedestrians and cyclists.

Though the prospects for further increases in speed are not good, thus ending the trend of a century, it is often claimed that the trend towards faster transport can, in effect, be continued through telecommunications. If communication through the video screen can be substituted for going to see people personally, then transport need no longer be a constraint on where people live. If the fashion is for a house in the hills or at the beach, and telecommunications enable people to work at home, what is to hinder them? The retirement resorts need no longer be reserved for retirees, but can accommodate a general dispersion from the cities. However, it should be remembered that telecommunications can at most allow only a minority to work at home — those mainly clerical and professional people who work with information, and do not require personal contact with other people or involvement in material production processes. Even here the extent to which telecommunications will do away with the need for face to face contact is uncertain. The effect of cheaper and better telecommunications may therefore be further decentralisation of some kinds of jobs (particularly central business district jobs), resulting perhaps in further urban growth in the resort areas — maybe to the point where they lose much of their attractiveness.

In the past improved telecommunications substituted for recreational travel (the TV replaced the suburban cinema) but the scope for further substitution of this kind is probably limited. Similarly the video screen is unlikely to substitute for personal contact in shopping, education or personal services. Those who find that they are free to move to the bush or to a resort, taking their work with them, will still have to weigh the benefits of the move against the loss of accessibility to urban facilities. Those who expect that the trend towards urban dispersion will continue, encouraged by improved telecommunications now that increases in speed are no longer in prospect, are perhaps the optimists. The pessimists rather ask: what will happen if we can no longer maintain present travel speeds? Even though the energy crisis of the 1970s, on which many of the pessimists
based their case, has passed on for the time being, it still makes sense to ask what happens when people lose the fast transport which supports their present routines. This exercise is relevant even if we no longer think that a general fuel shortage is likely, since individuals can lose access to fast transport even when it is still available to the majority. We will consider four cases: first, the case of passengers affected by the withdrawal of public transport services; second, the case of individual, isolated motorists denied the use of their cars; third, the case of motorists denied the use of their cars en masse by a shortage of fuel, and finally, the case of motorists denied access to some parts of the urban area by the imposition of traffic limitation policies.

The withdrawal of public transport

Even in the heyday of public transport it was not possible to set out at a random time in a random direction and be sure that a train, tram or bus would be available to speed the journey. Public transport services have always been patchily provided, both by geographic area and by time of day. In the years between 1880 and 1960 it was unusual for new outer suburbs to be built without reasonable public transport to the city centre, but crosstown connections were usually slow and sometimes lacking. Again, only on the most densely trafficked routes was it ever the practice to provide all-night services. However, train, tram and bus services carried nearly everybody bound on journeys longer than could be walked, and did so reasonably conveniently. People did not contemplate trips which could not be made by the public transport available to them, a limitation made quite bearable by the fact that most trip destinations were deliberately located so that people could reach them by public transport.

With the motor age came the decline of public transport. In established suburbs many tram and bus routes were withdrawn, and service frequencies declined on the remainder. New outer suburbs were built without the good bus services usual in older areas. The pattern of urban facilities changed to suit motor travel, such that to maintain the same level of accessibility for public transport patrons would have required improved services, not worse, while to provide them with the same level of accessibility as motorists now experienced was beyond the capabilities of public transport technology. All of these changes have disadvantaged people who continue to rely on public transport. The incidence of the disadvantage can best be assessed by considering what happens when a public transport service — say a suburban crosstown bus route — is abandoned.
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Except during strikes, bus services are not usually withdrawn overnight. Their decline is gradual, with trips being cut out as patronage falls. For this reason there is usually no great public outcry when the service eventually ceases, for its patrons have already melted away. It is usually assumed that most of them now travel at greater speed in private comfort by car, and that the switch away from the declining bus service was due to the superior attractions of motoring brought within reach by rising incomes. However, it should not be taken for granted that nobody was inconvenienced in this process. In addition to those former passengers who changed to motoring with the gladness of fulfilled ambition there may have been others who made the change reluctantly when convenient services were no longer available. Some may have brought cars, and others been reduced to cadging lifts - a stigmatised process now eulogised in the American literature as 'car pooling'. Some passengers - not necessarily those who could afford it - may have switched to taxis, and some may have rescheduled their activities to make the best use of what public transport services remained. Other former passengers may have been reduced to cycling or walking, and finally some may have given up and simply stayed home. The relative importance of these different reactions was likely to vary by trip purpose.

Work trips are sensitive to the provision of services at the right time to get workers to their workplaces just before work starts, and take them home after signing off. The cancellation of a particular bus service can thus result in public transport becoming inconvenient for the whole of a worker's work travel. Since work trips are a fundamental part of the daily pattern of activity they are unlikely to be abandoned, and since most employed people can afford car travel it is quite likely that declining bus services will oblige them to become motorists. However, some may seek lifts, and some may try to change their workplace to one that is accessible on foot or by the surviving public transport services. Perhaps the greatest hardship accrues to the carless unemployed, whose range of job search is diminished.

If school bus services are withdrawn then either parents have to chauffeur their children or the children themselves have to walk or cycle. Since the distances involved in the typical journey to school are well within cycling range, and usually within walking distance, the main argument against walking or cycling is danger. However, it is possible to make conditions safer for juvenile cyclists and pedestrians by the construction of special paths and by regulations such as lower speed limits enforced by speed bumps in residential areas.
Unfortunately such regulations are opposed by motorist groups, but they should be seen as one way to enable subsidised school buses to be withdrawn and taxes reduced.

Most single purpose shopping trips are made by people outside the workforce, who are in a position to vary the times at which they travel. Accordingly as public transport services decline it is usually possible to adjust. Even the most rudimentary service – three or four trips a day – can enable people to go shopping, though such poor services, and the high cost of home deliveries, give every incentive to seek alternatives. The members of one-car families can save their shopping for times when the car is available, though when the car is also used for work travel this can be quite a severe restriction. In the inner suburbs, with their numerous shopping centres, people without cars can if necessary confine their shopping to places within walking distance. In the outer suburbs, however, those who do not have cars often have no alternative but rely on bus services for their shopping trips. The complete withdrawal of such services cannot but cause hardship.

Of all the different kinds of travel, social and recreational trips are the kind where access to a variety of distant destinations is most valued. The greater geographic range of the motor car therefore sets it at a considerable advantage over public transport for this kind of travel, and gives the members of one-car families every incentive to save their recreational trips for times of day when the car is available. Young people without cars often resort to hitchhiking for their recreational trips, while others restrict their travel to places within cycling range, substituting the local swimming pool for the distant beach. Older people may respond to the decline of public transport by tailoring their trips to the reduced services, or by reducing trip frequencies, as when they give up visiting distant relatives because it has become too much bother.

The decline of any local bus service is usually so gradual that its effects are hard to discern. Strikes apart, there is only one case where people find themselves confronted with a dramatic reduction in the public transport services available to them, and this happens when a family moves house from an inner suburb with good services to an outer suburb with poor services. At the same time they shift from an area where many facilities are within walking distance to one designed on the assumption that cars are universally available, except to children on their journey to school. Very few carless families shift to such areas, but sometimes the promise of cheap accommodation overcomes the drawback of poor accessibility.

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Similarly many one-car families are attracted to the outer suburbs by the promise of home ownership, and once there find that they have to change their travel pattern drastically to make the most use of their one car. Some of the difficulties they experience are associated with the change of suburb, for if their workplaces and social contacts remain in or near their suburb of origin they are necessarily involved in a lot of travelling. This can be reduced by selecting destinations closer to hand. It has been observed that when the children start school, families become more closely tied to their new suburb, partly because of the increased difficulty of travelling with children in tow and partly because it is often through children that people make friends with neighbours (Faulkner 1978). However, since many facilities are beyond walking distance much of the inconvenience of the new suburb persists. The lack of facilities and poor bus services in the outer suburbs can combine to reorient families towards their house and garden and away from activities which involve travelling.

Except for the complete readjustment required when people shift to the outer suburbs, the gradual withdrawal of local bus services is thus matched by an equally gradual process of adjustment, some of which involves at least a degree of hardship. The level of public transport services may occasionally make the difference between having a job and being unemployed, or being able to visit one's friends and relatives and simply staying alone. The hardship that may be caused by the withdrawal of local bus services is one argument for subsidising them, the aims of the subsidy being to maintain minimum levels of mobility and of accessibility to facilities for people who cannot drive or for whom motoring is too costly.

The loss of the ability to drive

The withdrawal of public transport services is usually a gradual process, giving passengers time to adjust. By contrast, when motorists lose the use of their cars their mobility declines suddenly and perhaps traumatically. The loss can be for a matter of a few days or can be long-term, and it may happen to individuals in isolation or to many people at once. The most common short-term individual losses occur when cars are under repair, while in the long term individuals may have to give up driving either for financial reasons (their income has fallen drastically) or due to the loss of their driver's licence (either due to failing health or because they have been caught breaking the road rules). Such losses can become general if there are petrol shortages, which so far have
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only occurred due to the occasional strike but which may become chronic at some time in the future.

The options open to individual motorists who lose the use of their car are similar to those open to public transport patrons confronted with declining services. A motorist who has lost his licence may seek an unpaid chauffeur among the members of his family, or may court a prison sentence by driving unlicensed. Others who have lost their car may seek lifts from other drivers, or may (if their finances permit) take taxis. Others again may be reduced to using slower means of transport: trains, buses, cycles or even walking, with the concomitant reductions in journeying range. Finally, when the loss of the car is temporary, journeys will be postponed, and when it is long term they may be abandoned.

Every day in Australian cities there are motorists who temporarily or permanently lose the use of their cars. This causes little public concern; at the most it is regarded as a further argument for the maintenance of some sort of minimum bus service. Things are likely to be quite different, however, should people have to contemplate the loss of motor cars en masse as a consequence of fuel shortages. Governments may then have to think very hard about the provision of substitute transport services. In contemplating the possibilities it is as well to remember that the economic disruption brought about by shortages of petroleum is likely to affect far more than the urban transport sector, which may indeed be seen as a relatively low priority user. In such circumstances governments are unlikely to have the resources to invest in major improvements in public transport, and even if they do it is technologically impossible to provide cheap public transport with the same speed and same flexibility of direction as the motor car. Motorists forced from their cars en masse will thus be obliged to slow down just like the individual who loses the use of his car. The range of adjustment can thus be considered for both eventualities jointly.

The fact that most people still manage to get to work during periods of strike-induced petrol shortage indicates that alternative transport of a sort is available for most work journeys. However, it probably involves increases in journey duration which are more than could be borne on a regular basis, even after making allowance for the fact that people seem to be prepared to extend their journey times when using public transport. Among people denied the use of their cars those who can make the same journey without too great an increase in trip time (say an increase of no more than 30 minutes) may well transfer to public transport and continue to live and work in

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the same places, but those for whom journey duration is increased much more than this will have a strong incentive to seek a new home or a new workplace.

In Perth at the moment roughly 13 per cent of the workforce gets to work by public transport, but many more — perhaps as many as half the total — could switch to existing public transport services without their journey duration rising by more than half an hour each way (Bettison 1978). Such a considerable increase in public transport patronage would give the opportunity to introduce new services which could bring even more journeys within range.

In Sydney in 1971 about a third of all journeys to work were carried out by public transport or walking (Manning 1978:Ch 10). Perhaps half the motoring journeys were trips to the city centre or inner suburbs, or were local trips. Many of these could be transferred to walking or public transport without excessive increases in travel time. On the other hand, about a quarter of all journeys were long-distance trips originating in the outer suburbs, in areas where origin-destination flows were so diffuse that competitive public transport would be hard to provide. Even here it would be possible to design new bus routes to bring more journeys within range (CBR 1976:Ch 7).

Despite the contribution which may be made by new bus routes there would be many people for whom the time penalty of switching to public transport would be too great. Deprived of their cars, they would have a strong incentive to reduce journey distance. This may be more easily accomplished than many people imagine. Two-thirds of the population of Sydney or Melbourne could find jobs within the same region (that is, within 3 or 4 kilometres of home) if this were the overriding consideration in job selection, and many of the remainder could find jobs in the city centre and other inner suburbs accessible by radial public transport. The long run labour market cost of the reduction in mobility brought about by the loss of one's car is thus a restriction of job choice, but even then the choice remaining is still very wide. The jobs within reach by public transport from any dwelling in a city like Sydney or Melbourne would still be in excess of the total number of jobs available in any provincial city or country town, and in the inner and middle suburbs the excess would be considerable.

The loss of cars for school travel would be less serious. Because they are not allowed to drive most children get to school by walking, cycling or bus. However, quite a few parents now drive their children to school, perhaps in the course of other trips, but sometimes because the school is too far away or cannot be reached safely because of dangerous roads
to cross. Some of these trips might revert to walking and cycling, particularly if these were made safer.

Most new tertiary institutions are inaccessible by public transport and their students tend to come by car (Ogden 1973:399). Student incomes are, however, such that this is not now easy. Improved bus services and cycle paths would therefore be required. Forty per cent of all students at the suburban campus of the University of Canterbury (NZ) cycle or walk to their classes. Christchurch has a tradition of cycling, but with encouragement such figures may be attained elsewhere (Williams 1975:4).

Motor cars, with their one-family capacity and ability to go anywhere, were first marketed as recreational vehicles, and it is still for social and recreational travel that they are at their greatest advantage over alternative transport. Though recreational trips can be postponed and redirected and even abandoned without injury to the rest of a person's economic life (and indeed the response to a short-run petrol shortage is to cut down on recreational motoring) the limitation in the range of accessible recreational destinations is likely for many motorists to be the most keenly felt long-run deprivation resulting from the loss of their car. Accordingly it has been argued that petrol rationing schemes designed to cut down on car usage should favour rather than penalise recreational travel, and that in the event of petrol rationing so severe that people give up car ownership cars should still be available to them on hire to enable them to use their holiday ration (Stretton 1976:119).

Shopping is another activity where the car, with its ability to carry parcels and travel door to door, provides considerable advantages over walking or public transport. However, most houses in the inner and middle suburbs of Australian cities are within walking distance of a shopping centre, and most houses in the outer suburbs are within bus distance, and if home delivery services were revived the loss of cars for shopping trips should not cause much hardship except to the residents of outer suburbs grossly deficient in shops. From a businessman's point of view, however, change could be quite drastic. A petrol shortage would take away the highway trade and reduce the catchment area of regional shopping malls to that which can be served by bus. On the other hand, neighbourhood shopping centres would gain increased trade and the commercial fortunes of the city centres might revive a little in that they could once again benefit from their centrality in the urban rail systems.

Given that public transport is unavoidably slower than
motoring, due mainly to the necessity to walk and wait, reversion from motoring to trains and buses will inevitably involve a reduction in geographic range. If a petrol shortage is thought likely the best pre-emptive measures would be first, to keep the basic public transport service intact so that it can be expanded fairly rapidly if need be, and second, to control the layout of the city so that reasonable accessibility can be maintained even if people lose the use of their cars. Such policies would also safeguard the interests of individual motorists who have to give up motoring, and of captive public transport users who never adopt motoring.

Restrictions on motoring

The most severe reductions in speed come about when people have to step down from a faster means of transport to one which is slower. However, with the cessation of freeway construction in the inner and middle parts of Australian cities, and with the consequent continuing congestion (it being presumed that fuel shortages are not so severe that they limit the growth of motoring) it is possible that motorists may be faced with declining rather than constant speeds on many journeys. It is also possible that regulations may be imposed to restrict the amount of traffic using some roads, either to improve the inner suburban environment or in the interests of the speed of travel of the remaining traffic. In either case some motorists who might have used the road will be required to switch to alternative transport or alternative journeys.

Restrictions on motoring already exist. They are implemented through the road rules, which can be imposed with varying aims in mind. One aim is that of safety - hence speed limits and the like. Another is the maximisation of traffic flow - hence parking restrictions at the kerbs of main roads, restrictions on right-hand turns, and the like. Again, it may be desired to discriminate for or against certain classes of traffic - hence the banning of large vehicles in congested areas, the declaration of bus lanes, and similar measures. Finally, there may be restrictions designed to reduce the environmental costs of road traffic, generally by reducing traffic volume. The extreme case of this is the pedestrian mall, but restrictive licensing and partial street closure may also be used.

Australian motorists inherited from their horse and buggy predecessors the principle that the use of the roads should be free to all comers (Manning 1983:Ch 4). Like motorists elsewhere, they have defended these privileges, and hence have opposed any attempt to restrict the freedom of the open road,
both politically before the introduction of rules and passively afterwards by breaking the road rules when they think it safe. So far most rules have been introduced in the interests of safety and traffic flow maximisation, and even then they have not necessarily been acceptable (e.g. speed limits). However, the existence of congestion raises the question as to whether there should be more emphasis on giving priority to some vehicles over others, and the recognition that motoring involves environmental costs (noise, pollution and danger) has led to proposals for traffic limitation being taken seriously for the first time (Thomson 1977:Ch 7). It is in the inner and middle suburbs, where the streets were not designed with modern traffic in mind, that the strongest case can be made for regulations that limit traffic flows and discriminate between classes of vehicle.

Road transport interests have long insisted that the answer to road congestion is to build more roads. However, this argument overlooks the fact that road construction in the inner and middle suburbs is exceedingly expensive, and that the expense must be weighed against alternative national investments. Given that the provision of roadspace to serve all comers is neither practicable nor desirable economists have long proposed that road congestion should be reduced by sorting out the high priority from the low priority road users, and discouraging the latter. The economists' preferred criterion for sorting out high and low priority road users is generally the toll they would be willing to pay, but this criterion has been rejected on the grounds that it is hard to administer and also raises strong political objections: motorists are opposed to having to pay more to drive, and again tolls discriminate against low-income road users. However, other means are available to decide between high and low priority traffic. One is vehicle occupancy. If the aim of regulation is to maximise passenger rather than vehicle flow regulations should favour high occupancy vehicles, like buses and full cars. Another possibility is that regulation could favour commercial traffic on the grounds that delays due to congestion raise costs, and the commercial traffic has no option but to use the roads, whereas private motorists could transfer to public transport or change their journey pattern (Gilmour 1978:Ch 5).

The difference between traffic restraint policies imposed for the relief of congestion and those imposed on environmental grounds is that the latter generally aim at a great reduction in traffic and also tend to discriminate against commercial traffic on the grounds that it is noisier and more dangerous than private motoring. However, since traffic restraints can
be made to apply to individual roads and streets, there is no necessary incompatibility between measures imposed for environmental reasons and those imposed to reduce congestion: congestion-relieving, traffic maximising policies can be applied on designated main roads and environmental improvement restricted to areas where it does not hinder traffic movement. Similarly preference for commercial vehicles on main roads can be combined with their prohibition in residential streets except where necessary to gain access to buildings.

The argument put forward by the roads lobby against traffic restraint is the same as their argument in favour of inner area freeway construction. It is that if the accessibility of inner and middle suburban sites to car-borne traffic is reduced, economic activity will shift to the outer suburbs which can accommodate motor traffic. The counter argument is that the improved environmental conditions resulting from traffic restraint will reduce the incentive for inner area residents to move to the outer suburbs, while at the same time regulations favouring commercial vehicles will reduce incentives for business to relocate. In any case, a certain continued migration of businesses from the inner to the outer areas is arguably desirable in most Australian cities to give better local balance between workers' houses and job opportunities.

If traffic restraint is applied mainly to reduce congestion at peak hours its main effect will be to curtail mobility for the journey to work. Two main classes of workers would be affected: those who live in the inner and middle suburbs and drive to work, and those who live in the outer suburbs and drive to jobs in the inner and middle areas. This means that there are potential adverse effects for a majority of workers in the inner suburbs and for a large number of those who live in the outer areas, the exact proportions varying in the different cities. Some workers - by no means all, or even the majority - in both categories would be obliged either to change their means of transport or to change their house or workplace. As with those who lose the use of their cars there will be some for whom public transport is a relatively convenient substitute, and some for whom it involves unacceptable increases in travelling time. The chances of success of traffic restraint measures would be enhanced if they could be combined with improvements to public transport which increase the ease with which trips can be transferred, and may be more acceptable politically if the measures discriminate against those car journeys for which public transport is available rather than those which cannot easily change over. If this is done traffic restraint need not inconvenience many people, nor
need it restrict the range of job choice more than marginally for anybody.

Speed reductions and public policy

These four examples should be sufficient to show that whether or not there is eventually a fuel shortage there will be citizens troubled by the loss of fast transport. Three of the four examples assume that petrol or its substitutes will continue to flow and motoring will remain the preferred means of transport for most trips longer than walking distance. If the motor car remains as popular as it is now people dependent on it will continue to be troubled by the lurking fear that they may lose their driver's licence, whether due to police action or bad eyesight. Again, the trauma of unemployment, sickness, marital desertion or other such sudden reductions in income will continue to be worsened by the loss of mobility when people find that they can no longer afford their car. Public transport services will continue to operate under threat of withdrawal by profit-minded governments, while the conflict of interest between local residents and motorists will from time to time be resolved in the residents' favour and restrictions imposed which reduce traffic speeds or limit traffic flow. In each case a group of people - a family or a group of travellers - suffers reductions in journeying range which are similar to those which would occur more widely should a fuel shortage force people to lay-up their cars.

In each example it was proposed that hardship could be reduced in two ways. First, when people are obliged to adjust to reduced speed they have to accustom themselves to a reduction in geographical range. It helps if the reduction in range is as small as possible, and if it is so managed that important destinations do not move out of range. Second, the location of facilities can be influenced so that people affected by reductions in travelling range suffer as small a worsening of accessibility as possible.

Some idea of the significance of a reduction in geographic range can be obtained from a few calculations. Taking 30 minutes as the acceptable duration of a motoring or walking journey, and with an allowance for the indirectness of transport routes, it can be calculated that the range defined by motoring distance in an Australian suburban area is about 300 square kilometres, while the range within walking distance is about 12 square kilometres. The typical range within public transport distance is much harder to calculate, since so much depends on the availability of routes and services. Again, it has been observed that people are willing to endure public
transport journeys that take a little longer than the acceptable time for walking or motoring. Specifying this time as 40 minutes, and assuming a reasonably complete network of bus services (but no trains) the area within public transport distance would be about 75 square kilometres. Extending the acceptable journey time to 60 minutes and inserting a network of rail lines would increase the public transport range to motoring levels, though it would still be smaller than motoring range at 60 minute journey times.

On these calculations the reduction in geographic range consequent on the loss of a motor car depends on the extent to which the motorist is willing to extend his journey times and on the quality of the public transport services available to him. If there is no public transport and he is not willing to spend more time travelling he plummets straight from a 300 square kilometre range to the 12 square kilometres accessible on foot (For simplicity cycling is ignored.) On the other hand, if he is willing to extend his journey times and public transport is excellent (better than in any Australian city) he may be able to maintain his range. Between these extremes there are many other possible outcomes, but the calculated reduction to 75 square kilometres would be a typical reduction in a city area where bus services were reasonably frequent and gave good route coverage.

As pointed out already, the withdrawal of public transport services is a less traumatic event for the people affected than the loss of a car. Journeying range gradually diminishes, more at some times of day than others, till by the time of the final withdrawal of all services public transport may be offering very little extension to walking range. However, the contrast remains: a good bus service can give access to about 75 square kilometres, which is approximately six times the area within walking distance.

The significance of these figures, however, does not lie in the number of square kilometres which people can no longer reach, but in the facilities to which they lose access. This in turn depends on the layout of the particular metropolitan area and where they live in it. Some idea of the significance of the reduction in accessible area can be gained by calculating the population likely to live within journeying range. At Melbourne average population densities motoring range is likely to house a population of 500,000, bus range 125,000 and walking range 22,000. At outer suburban densities these populations would perhaps be halved, but they could equally be doubled if population densities returned to the level of the 1920s. Such density increases would involve being
careful with the use of land, but could be achieved without sacrifice of the detached house and its garden. Densities at this level are medium by world standards.

A further step in assessing the significance of reductions in accessible area is to consider these populations as though they were separate, self-contained settlements rather than segments of metropolitan areas. Half a million people is the population of a substantial city with plentiful job choice and a complete range of cultural facilities; 125,000 is that of a provincial city with a good range of jobs, a full-sized shopping centre, a university and the chance of a live theatre, while 22,000 is the population of a significant country town with a variety of shops, a couple of high schools, a hospital and a somewhat restricted range of job opportunities. In so far as population indicates facilities available, a good bus service is equivalent to the difference between living in a country town and a provincial city. It significantly increases job choice and the educational and cultural facilities within reach. By contrast the step up from buses to motoring merely adds icing on the cake; it adds choice, but only a few of the more esoteric options are new in kind rather than quantity.

The obvious fault in the calculations is that segments of metropolitan areas are not self-contained settlements. Instead facilities are agglomerated so that some suburbs have plenty and others few. Thus walking range in the outer suburbs may boast little more than a shop or two and a primary school, and even within bus range the choice of jobs may be severely limited. By contrast, walking range in the inner areas may encompass facilities quite the equal of a provincial city. The obvious policy to minimise the hardship caused by the loss of fast transport is to redistribute facilities so that each metropolitan region, defined by bus-range, is potentially self-contained like a provincial city, and similarly so that each neighbourhood is like a walking-distance country town.

Reasoning like this leads to the specification of ideal town plans (Edwards and Schoper 1976). The city should be divided into neighbourhoods, each with as many facilities as its population can reasonably support unaided. These should be grouped into metropolitan regions, and each region should have a centre to which access is assured by bus. In or near this centre can be located all the employment, commercial and cultural facilities appropriate to a city of 125,000 people. In this way it would be possible to provide almost all the benefits of urban motoring without any cars - just buses or electric trams. In particular there would be no need to sacrifice the low residential densities that are probably the
most valued benefit of fast transport. Further, in such a town planning scheme it would be possible to provide the icing on the cake - the esoteric options and the extra scope for choice - by means of a rapid transit line linking the centres of each metropolitan region. Regular users of this service would suffer a time penalty compared with people who confined their activities to their own region, but such is not unreasonable as the price of discriminating choice.

Urban designs like this are not a daydream; they are fully within the bounds of possibility, and they work. The idea of a series of neighbourhoods adding up to balanced metropolitan regions was adopted as the plan for Canberra in the 1960s, and this plan was implemented (Stretton 1970:Ch 4). The acceptable duration of a walking trip was taken as about 15 minutes, a reasonable estimate for a city in which motor cars are the main means of travel. As a result the neighbourhoods are fairly small, but each supports a local shopping centre and a primary school. These neighbourhood suburbs add up to three balanced metropolitan regions, in each of which a full range of facilities is located in the town centre at the focus of the bus routes. However, Canberra is the only Australian city designed on these principles, and indeed is one of the very few in the Western world. Why aren't such designs more common?

We may cite three reasons: first, the economies of scale and agglomeration. It is claimed that dividing the facilities of a large city into regional units sacrifices the benefits of a large city: the vibrant central business district, the large sophisticated hospitals, the symbolic opera house. In Canberra government departments vie for offices close to Parliament House, and banishment to the other two centres is regarded as symbolising lost political influence. The heads of the banished departments, if not their minions, would perhaps prefer that all offices were in one place. Again, a hospital has been provided in each of the three balanced towns, but for some strange reason each hospital has been built larger than need be. Two would do. Similarly there are complaints against the neighbourhood centres. The chain stores would prefer that their shopping malls were not subject to the competition of small neighbourhood shopkeepers. They argue that this limits their ability to sell in bulk and so keep prices down.

Second, the planner's achievements in Canberra were only possible because a powerful town planning administration had the full backing of the government, and full control over urban development, including the location of housing and to a great degree the location of employment. In other cities planners have far less power. They can prohibit undesirable
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developments in particular areas, but can do very little to build up regional centres at their selected sites. Instead, land-use decisions are made by individual landowners who are under no compulsion to consider the effects of their decisions on the layout of the metropolitan area as a whole. Such decisions therefore tend to be conservative and incremental: add a housing estate here, build a new shopping centre on cheap land there, and so on. In such cities it can be argued that any attempt by planners to promote the decentralisation of jobs and facilities to regional centres will end up merely accentuating the way the market responds to widespread motoring by scattering facilities. Such layouts are hopeless from a transport point of view, and it might be better for the town planners in such cities to devote their limited powers to maintaining the single centre and the public transport links that serve it rather than trying to promote regional centres.

Third, it may be argued that as long as motoring remains the chief means of transport the provision of regional centres has no point, and may even be a perverse step. Dispersing employment to regional centres has the potential to result in longer rather than shorter average journeys to work compared with the single-centred city. The same applies to scattering employment locations. However, this can only happen when people deliberately choose a far-away job. Given that it is duration rather than distance which is constant, the worst that can happen is that motorists' journey length will expand to fill the time available. Only if the provision of regional centres is accompanied by increased motoring speeds is it at all likely that average journey distances will rise above those in the equivalent single-centred city. As it happens, this is a possible result in Canberra, for the town planning authorities there have combined their regional centre layout with a policy of providing lavish road capacity so that traffic is never held up by congestion. The authorities argue that these two policies are not inconsistent; it is only possible to provide excess road capacity because long-distance traffic demand is limited by the attractions of the town centres, one of which is their accessibility by bus. It has further been established that long distance work journeys in Canberra are not usually the result of deliberate choice. Canberra citizens when buying a house tend to buy in the region in which they work, but if in the course of their career they are transferred to work in one of the other two centres they do not go to the trouble of shifting house. The new job location is still within an acceptable journey time by car, and indeed is likely to be within reach by express bus. The experience in Canberra,
THE LOSS OF SPEED

therefore, is that a regional centre approach to city design can bring more journeys within bus distance than either a single-centred or a scattered design. This benefits present-day bus travellers and has the potential to benefit future bus users should a fuel crisis prise people out of their cars. At the same time it assists in the limitation of traffic congestion.

The argument that the provision of regional centres is pointless is thus hardly worth considering; it is a counsel of defeat and assumes that the needs of non-motorists can be disregarded both now and in the future. On the other hand, the economies of scale argument applies quite strongly at a walking-distance level. If urban facilities were so split up that each neighbourhood had the same variety as a freestanding country town of similar population then not only would some kinds of installation fall below the minimum efficient size (e.g. tertiary institutes, large factories and perhaps hospitals) but at a metropolitan scale the effect would be such a scatter that it would be very difficult to provide public transport. It is therefore better to provide at a walking-distance level only those facilities which can operate efficiently even though they do not draw customers from outside the neighbourhood—schools and local shops.

These recommendations on the location of facilities assume that locations are changing. Such policies are most appropriate in times of urban growth. If cities are not growing the building-up of regional centres is a slow business. Again, if a fuel shortage actually strikes it will bring economic chaos so severe that there will not be the time nor the capital to change the urban layout. In such circumstances town planning and location policy alone will not be able to maintain accessibility, and may be unable to make much contribution at all. It may therefore become important to minimise the loss of geographic range. It was argued in each of the examples above that this implies continued subsidies to public transport.

Though in each example public transport subsidies were seen as desirable the reason was not in each case the same. When considering the provision of a minimum standard of mobility for people without cars the argument ran that it is unfair to deprive urban citizens of a basic level of mobility. However, when considering public transport subsidies in relation to the costs of motoring the argument was essentially that motoring is underpriced. Fuel should be more expensive to conserve supplies for the future, and in addition motorists should be charged rent on the land devoted to roads and also compensation
for the pollution and noise they cause. Since these charges are missing there should be corrective subsidies to motoring's chief competitor (Thomson 1977:Ch 2). The logic of this argument is that subsidies should be withdrawn as soon as suitable charges are imposed on motorists, as they might be in the event of a fuel shortage, or in the course of implementing schemes of traffic restraint. However, here we encounter a third justification of subsidies to public transport: they may be politically desirable as part compensation to ex-motorists smarting from their loss of speed. It would be a tough-minded and secure government which could restrain motoring and double fares at the same time.

This justification for public transport subsidies does not mean that present levels of service and fares are the best obtainable. Service standards are still set mainly by rule of thumb, and often the route pattern is ossified. Subsidy levels, fares and services should all be subject to review. Such reviews cannot but be complex, given the numerous joint costs that recur in public transport operations, and the varying rationale for subsidies. The social welfare argument justifies an emphasis on minimum service standards, but if this results in buses running empty simply to provide the standard service to a scattering of hobby farmers on the urban fringe it has been taken to excess. Conversely, the countervailing subsidy argument, whether economic or political, would direct funds to the improvement of those public transport services which are most competitive with motoring. This may result in good services at low fares being provided for people who could well afford to pay for them in full. A modus vivendi has to be found between these two approaches.

In setting minimum service standards it may help to remember that public transport is but one of a number of public services which are provided in urban areas and not at all, or in different form, elsewhere. Like the public transport operators, the authorities charged with providing water and sewerage have an interest in limiting urban development to a defined area. It seems sensible to make that area coincide for sewerage, public transport and any other relevant authorities. Within the area so described it should be remembered that no suburb will be without its non-motorists. The suggestion that some suburbs should be declared for motorists only, and public transport not provided, is unfair to children and to residents who lose the use of their car. It might also help to define minimum service standards in terms of accessibility rather than bus route characteristics: access in reasonable time by bus to so many jobs, to schools and to a full-scale shopping centre.
The notion of conventional journey time can help in identifying traffic where public transport can compete with the motor car. It is foolish to compete for long-distance traffic where bus journey times are longer than a satisfactory journey duration. On the other hand, it should be possible to compete more aggressively for journeys at around the half hour duration by tram or bus, even when public transport is at a time disadvantage over motoring.

These policies are very much the conventional town planning wisdom. Subsidies to public transport are an accomplished fact, and the more wide-awake operating authorities are already looking for ways to recast their services so that they are more appropriate to the present age. Similarly the promotion of metropolitan regional centres was the conventional wisdom of the post-war years, the reason that they were not actually built except in Canberra being the small power of town planners and the large power of interests committed to incremental urban growth. Yet these conventional policies would best serve to prepare Australian cities for a fuel shortage, should there be one, and even if such a shortage never comes to pass would assist in the maintenance of minimum levels of accessibility for citizens without cars.

None of this is to deny the strength of most citizens' attachment to their cars, nor is it to claim that people will stop motoring unless forced to do so. However, it is easy to overestimate the benefits of motoring, and underestimate its costs. Should politicians ever be tempted to resort to nuclear war to maintain petrol supplies for a few more years the right decision is obvious: better alive and walking than driving to death on a radioactive earth.
Appendix

The estimates reported in Chapter 3 of the local balance between residents and employment opportunities, and the residents' response rates, were based on a detailed investigation of the location of jobs in relation to dwellings for Sydney and Melbourne in the post-war period. This appendix reports the results of the detailed investigation.

Information for Melbourne in 1951 was available only for Board of Works Planning Zones, which were far from ideal for the purpose of assessing response rates since they varied greatly in area and since many were drawn as radial segments of the metropolitan area rather than approximately square. However, the statistics reported in Map 6.1 suffice to show that Melbourne in 1951 was quite strongly centralised. There were job surpluses only in the city centre, the inner industrial suburbs and the western suburbs. These regions where jobs outnumbered resident workers were nearly all on the basalt plains, beginning with the Yarra River east of the city centre and extending in an arc to peter out in the west. The non-basalt parts of the metropolitan area were all short of jobs. This was even true of Frankston, a commuter suburb, despite its considerable distance from the city centre. Though the figures are not given in enough detail to prove this, it seems that Melbourne was not ringed by outer suburbs more or less self-sufficient in jobs. Certainly it had no major freestanding suburban employment centre to rival Parramatta/Auburn in Sydney.

In Sydney at the end of the Second World War job surpluses were concentrated in the city centre and in some of the then outer western suburbs (Map 6.2). In view of the job deficits that later developed in Bankstown and Liverpool it is important to note that in 1945 these two municipalities were self-sufficient in jobs, while at Parramatta/Auburn Sydney already had a major suburban employment area located 15 to 20 kilometres from the city centre, and separated from it by largely residential suburbs. Further out again, and at this
time well beyond the urban boundary, Blacktown and Campbelltown existed as semi-independent country towns. In the 1940s employment in suburban Sydney was better balanced against the residential distribution of the population than in Melbourne.

During the 1950s employment growth in Melbourne was concentrated in the western and south eastern suburbs (Table 6.1). Much of it was close to the urban fringe, and so gave people the opportunity to move out without increasing their work journey distances. There was little employment growth in either the city centre or the inner suburbs. The effect of motorisation can be seen in this pattern: employers were selecting cheap land in the outer suburbs, and relying on trucks for goods transport and trusting that enough workers had private cars to attract a workforce (though some outer suburban employers in this era made special public transport arrangements, e.g. the extension of the suburban train service beyond Dandenong to General Motors). The pattern of population growth was as expected given this decentralisation of jobs and

Table 6.1 Jobs and resident workforce
Melbourne, 1951 and 1961

<table>
<thead>
<tr>
<th>Region</th>
<th>Jobs (’000)</th>
<th>Resident workforce (’000)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1951</td>
<td>1961</td>
</tr>
<tr>
<td>Central Business District</td>
<td>164</td>
<td>155–</td>
</tr>
<tr>
<td>Rest of Melbourne, Port</td>
<td>125</td>
<td>138–</td>
</tr>
<tr>
<td>Melbourne, South Melbourne</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitzroy, Collingwood, Richmond</td>
<td>63</td>
<td>61</td>
</tr>
<tr>
<td>Western suburbs</td>
<td>51</td>
<td>67</td>
</tr>
<tr>
<td>North western suburbs</td>
<td>25</td>
<td>33</td>
</tr>
<tr>
<td>Northern suburbs</td>
<td>38</td>
<td>48</td>
</tr>
<tr>
<td>North eastern suburbs</td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td>Camberwell, Box Hill, Nunawading</td>
<td>17</td>
<td>26</td>
</tr>
<tr>
<td>Prahran and St Kilda</td>
<td>33</td>
<td>27</td>
</tr>
<tr>
<td>Malvern and Caulfield</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Middle southern suburbs</td>
<td>28</td>
<td>45</td>
</tr>
<tr>
<td>Waverley and Dandenong</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Outer southern suburbs</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>592</td>
<td>674</td>
</tr>
</tbody>
</table>

### Table 6.2 Jobs and resident workforce, Melbourne, 1961 and 1971

<table>
<thead>
<tr>
<th>Region</th>
<th>Jobs ('000)</th>
<th>Resident workforce ('000)</th>
<th>1961</th>
<th>1971</th>
<th>1961</th>
<th>1971</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Business District</td>
<td>155</td>
<td>120-</td>
<td>50</td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melbourne, Port Melbourne &amp; South Melbourne</td>
<td>138</td>
<td>149-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner southern suburbs</td>
<td>71</td>
<td>80</td>
<td>96</td>
<td>97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner north-eastern suburbs</td>
<td>75</td>
<td>74</td>
<td>72</td>
<td>68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Williamstown, Footscray, Essendon</td>
<td>50</td>
<td>51</td>
<td>60</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Altona</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunshine</td>
<td>22</td>
<td>24</td>
<td>22</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coburg and Preston</td>
<td>27</td>
<td>37</td>
<td>55</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kellor</td>
<td>7</td>
<td>8</td>
<td>11</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heidelberg and Diamond Valley</td>
<td>9</td>
<td>14</td>
<td>29</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camberwell and Box Hill</td>
<td>19</td>
<td>26</td>
<td>53</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doncaster and Templestowe</td>
<td>2</td>
<td>7</td>
<td>6</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nunawading</td>
<td>6</td>
<td>15</td>
<td>17</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ringwood and Croydon</td>
<td>6</td>
<td>13</td>
<td>12</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lilydale</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knox and Sherbrooke</td>
<td>4</td>
<td>9</td>
<td>10</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caulfield and Brighton</td>
<td>16</td>
<td>19</td>
<td>45</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandringham, Mordialloc, Chelsea</td>
<td>10</td>
<td>15</td>
<td>29</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frankston</td>
<td>4</td>
<td>9</td>
<td>7</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oakleigh and Moorabbin</td>
<td>35</td>
<td>67</td>
<td>49</td>
<td>64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waverley</td>
<td>5</td>
<td>17</td>
<td>4</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dandenong</td>
<td>6</td>
<td>12</td>
<td>7</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Springvale</td>
<td>5</td>
<td>10</td>
<td>9</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>690</strong></td>
<td><strong>797</strong></td>
<td><strong>690</strong></td>
<td><strong>802</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Workers with variable or unknown workplaces are excluded.

the introduction of faster transport. The number of workers living in the inner suburbs declined, and there were increases in almost all the outer areas. The reason that the proportion able to work locally did not increase overall was not due to any lack of jobs moving into the new suburbs but to the speed of the exodus from the old: these were and (despite low employment growth rates) remained areas of job surplus, and every resident who left was one person less who could work
During the 1960s job decentralisation in Melbourne continued (Table 6.2). Employment in the central area and inner suburbs declined - or perhaps remained roughly constant, for there are differences of definition between the 1961 and 1971 censuses which make it impossible to be certain about small changes. It is, however, certain that employment growth in the western suburbs slowed down and in the south east sped up, so that by 1971 Melbourne had in Moorabbin/Oakleigh a suburban employment centre to rival Parramatta/Auburn in Sydney, located at a similar distance from the city centre in the direction of greatest population growth. The reasons for the rise of Moorabbin/Oakleigh would include the effects of the motor truck in cutting industrial development loose from its ties to the port and railway lines, and may also reflect employers seeking sites close to where people preferred to live. As with the suburbanisation of employment generally, the rise of Moorabbin/Oakleigh made opportunities available to extend the urban boundary without increasing journey distances. These opportunities were taken, and most of the extensions to the urban area of Melbourne during the 1960s were to the east. Very few of the new suburbs were convenient to anywhere by public transport, but particularly from the municipalities of Waverley and Moorabbin the motorist had a wide choice of jobs within a few minutes' driving time. About a third of Melbourne's population increase during the decade was accommodated in these two local government areas, by contrast there was no net population growth in the pre-war city, and not much on the western or northern fringe, for in these areas employment had stopped growing. The balance between jobs and resident workers accordingly improved in most suburbs except those on the western side of the city.

This worsening of local balance in the western suburbs was accompanied by an increased response rate. The main residential advantages of the western suburbs were cheap land and plentiful local employment. People who came to live in the west expected to be able to work there, and their efforts to do so were probably responsible for the increased response rate (Tables 6.3 and 6.4).

By contrast, employment and population growth in the eastern suburbs was accompanied by improved local balance and a reduced response rate. People were bypassing more local jobs on the way to where they actually worked. Given time they may have sorted things out so that response rates increased again - in 1971 many of the older residents of the outer suburbs would still have been working at distant jobs which they chose when
local employment was less readily available. Overall the proportion working locally increased in those regions where the improvement in local balance was strong enough to cancel out the reduction in response, but it fell elsewhere.

Table 6.3 Residents working in the same planning region, Melbourne, 1951 and 1961

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage able to work in the same region</th>
<th>Percentage working in the same region</th>
<th>Response rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melbourne, Port Melbourne</td>
<td>100</td>
<td>75</td>
<td>75 77</td>
</tr>
<tr>
<td>South Melbourne</td>
<td>100</td>
<td>46</td>
<td>46 48</td>
</tr>
<tr>
<td>Fitzroy, Collingwood, Richmond</td>
<td>100</td>
<td>72</td>
<td>72 67</td>
</tr>
<tr>
<td>Western suburbs</td>
<td>100</td>
<td>29</td>
<td>29 66</td>
</tr>
<tr>
<td>North western suburbs</td>
<td>44</td>
<td>33</td>
<td>33 61</td>
</tr>
<tr>
<td>Northern suburbs</td>
<td>54</td>
<td>22</td>
<td>22 54</td>
</tr>
<tr>
<td>North eastern suburbs</td>
<td>41</td>
<td>26</td>
<td>26 73</td>
</tr>
<tr>
<td>Camberwell, Box Hill, Nunawading</td>
<td>36</td>
<td>24</td>
<td>24 84</td>
</tr>
<tr>
<td>Prahran and St Kilda</td>
<td>57</td>
<td>29</td>
<td>29 51 46</td>
</tr>
<tr>
<td>Malvern and Caulfield</td>
<td>30</td>
<td>18</td>
<td>18 61 48</td>
</tr>
<tr>
<td>Middle southern suburbs</td>
<td>51</td>
<td>36</td>
<td>36 71</td>
</tr>
<tr>
<td>Waverley and Dandenong</td>
<td>47</td>
<td>37</td>
<td>37 79</td>
</tr>
<tr>
<td>Outer southern suburbs</td>
<td>44</td>
<td>43</td>
<td>43 97 80</td>
</tr>
<tr>
<td><strong>OVERALL AVERAGE</strong></td>
<td><strong>61</strong></td>
<td><strong>39</strong></td>
<td><strong>65 61</strong></td>
</tr>
</tbody>
</table>

Sources: 1951: Borrie, 1954.
1961: Census Journey to Work tables.

The story of post-war expansion in Sydney differed from that in Melbourne in several respects, not least the starting point. As already mentioned Sydney in 1945 had a major suburban concentration of employment at Parramatta/Auburn, something Melbourne lacked. In the Victorian capital nearly all post-war employment growth was in areas which were green paddocks in 1945; by contrast a third of the growth in employment in the Sydney metropolitan area during the 1950s was concentrated in the city centre and its environs, including North Sydney (Table 6.5). The greater part of the rest of the growth in that
### Table 6.4 Residents working in the same region, Melbourne, 1961 and 1971

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage able to work in the same region 1961</th>
<th>Percentage able to work in the same region 1971</th>
<th>Response rate (%) 1961</th>
<th>Response rate (%) 1971</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melbourne, Port Melb, South Melbourne</td>
<td>100</td>
<td>100</td>
<td>77</td>
<td>74</td>
</tr>
<tr>
<td>Inner southern suburbs</td>
<td>74</td>
<td>82</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Inner north-eastern suburbs</td>
<td>100</td>
<td>100</td>
<td>41</td>
<td>43</td>
</tr>
<tr>
<td>Footscray, Essendon, Williamstown</td>
<td>83</td>
<td>92</td>
<td>43</td>
<td>42</td>
</tr>
<tr>
<td>Altona</td>
<td>65</td>
<td>61</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Sunshine</td>
<td>100</td>
<td>82</td>
<td>45</td>
<td>38</td>
</tr>
<tr>
<td>Coburg and Preston</td>
<td>48</td>
<td>65</td>
<td>27</td>
<td>35</td>
</tr>
<tr>
<td>Keilor</td>
<td>70</td>
<td>45</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Heidelberg, Diamond Valley</td>
<td>32</td>
<td>47</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>Camberwell, Box Hill</td>
<td>37</td>
<td>47</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>Doncaster, Templestowe</td>
<td>30</td>
<td>33</td>
<td>18</td>
<td>17</td>
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<tr>
<td>Nunawading</td>
<td>38</td>
<td>46</td>
<td>19</td>
<td>22</td>
</tr>
<tr>
<td>Ringwood and Croydon</td>
<td>48</td>
<td>61</td>
<td>27</td>
<td>31</td>
</tr>
<tr>
<td>Lilydale</td>
<td>54</td>
<td>51</td>
<td>39</td>
<td>32</td>
</tr>
<tr>
<td>Knox and Sherbrooke</td>
<td>43</td>
<td>57</td>
<td>34</td>
<td>32</td>
</tr>
<tr>
<td>Caulfield and Brighton</td>
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<td>40</td>
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<td>19</td>
</tr>
<tr>
<td>Mordialloc, Chelsea, Sandringham</td>
<td>36</td>
<td>43</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>Frankston</td>
<td>54</td>
<td>49</td>
<td>45</td>
<td>41</td>
</tr>
<tr>
<td>Oakleigh and Moorabbin</td>
<td>72</td>
<td>100</td>
<td>35</td>
<td>43</td>
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<tr>
<td>Waverley</td>
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<td>Dandenong</td>
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<td>80</td>
<td>40</td>
<td>42</td>
</tr>
<tr>
<td>Springvale</td>
<td>56</td>
<td>60</td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td><strong>OVERALL AVERAGE</strong></td>
<td><strong>64</strong></td>
<td><strong>70</strong></td>
<td><strong>33</strong></td>
<td><strong>33</strong></td>
</tr>
</tbody>
</table>

Source: Census Journey to Work tables.
decade was in established outer suburban employment centres like Parramatta/Auburn and Bankstown. The increase in the number of jobs available in the western suburbs permitted an extension of the fringe without increasing journey distances, but the increased employment in the city centre was located a long way from any vacant residential land. If the people who took these extra jobs lived on the fringe then journey lengths would increase; if they lived in the established nearby suburbs densities would increase.

Despite the fact that city centre employment increased in Sydney and fell in Melbourne the increase in average journey distance was similar in the two cities. The only obvious difference during the 1950s was that in Sydney the population of the inner suburbs did not fall as rapidly as in Melbourne. In both cities the journey distances of those who worked in the city centre were increasing, though perhaps not to the full extent predicted by the single-centre model. (This can be deduced from rail journey distances, which were chiefly influenced by city centre traffic.) Despite the increase in city centre employment in Sydney, the relative importance of the central business district declined in both cities, and the increase in the length of city centre journeys was increasingly masked by a rising proportion of constant-length inter-suburban journeys.

In Sydney during the 1950s the most rapid population increases were in two kinds of area: first, fringe areas relatively close to the city centre, and second, the outskirts around and beyond the established western suburban employment areas (Table 6.5). The first kind of area was typified by Sutherland Shire, whose accessibility to the city centre had been greatly improved during the late 1930s by the opening of the Cronulla railway line. The motor car also meant that Sutherland residents could reach jobs in the South Sydney and Bankstown industrial areas, though when too many tried to do so they quickly clogged the bridges over the Georges River which separates Sutherland from the rest of Sydney. Manly/Warringah was also relatively close to the city centre and relatively empty, but it received no new railway line and its expansion was eventually limited by the capacity of the roads connecting it to the rest of Sydney, as well as by town planning restrictions.

Expansion on the western fringe occurred quite rapidly during the 1950s in places like Blacktown and Fairfield. In 1945 these had had a fair balance of local job opportunities—the nearest job surpluses were in Parramatta/Auburn, five to ten kilometres inside the fringe.
Table 6.5 Jobs and resident workforce, Sydney, 1945, 1961 and 1971

<table>
<thead>
<tr>
<th>Region</th>
<th>Jobs ('000)</th>
<th>Resident workforce ('000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Business District</td>
<td>200 219 201</td>
<td>150 120 91</td>
</tr>
<tr>
<td>Rest of Sydney, Woollahra, Waverley</td>
<td>152 173 169</td>
<td>150 120 91</td>
</tr>
<tr>
<td>Botany and Randwick</td>
<td>30 44 56</td>
<td>52 55 67</td>
</tr>
<tr>
<td>Inner western suburbs</td>
<td>82 87 103</td>
<td>117 108 117</td>
</tr>
<tr>
<td>Rockdale and Kogarah</td>
<td>12 21 28</td>
<td>42 50 53</td>
</tr>
<tr>
<td>Canterbury and Hurstville</td>
<td>17 30 42</td>
<td>46 66 79</td>
</tr>
<tr>
<td>Sutherland</td>
<td>5 14 28</td>
<td>8 41 56</td>
</tr>
<tr>
<td>Bankstown</td>
<td>15 33 55</td>
<td>12 53 66</td>
</tr>
<tr>
<td>Auburn, Strathfield</td>
<td>24 42 53</td>
<td>26 29 30</td>
</tr>
<tr>
<td>Parramatta</td>
<td>21 36 51</td>
<td>19 35 42</td>
</tr>
<tr>
<td>Holroyd</td>
<td>4 7 16</td>
<td>7 19 29</td>
</tr>
<tr>
<td>Fairfield</td>
<td>6 9 19</td>
<td>8 25 40</td>
</tr>
<tr>
<td>Liverpool</td>
<td>3 10 21</td>
<td>3 11 27</td>
</tr>
<tr>
<td>Campbelltown</td>
<td>1 3 7</td>
<td>2 6 11</td>
</tr>
<tr>
<td>Blacktown</td>
<td>5 10 22</td>
<td>6 25 51</td>
</tr>
<tr>
<td>Penrith</td>
<td>3 8 17</td>
<td>5 14 20</td>
</tr>
<tr>
<td>Inner northern suburbs</td>
<td>20 43 72</td>
<td>60 65 72</td>
</tr>
<tr>
<td>Ryde and Hunters Hill</td>
<td>7 16 28</td>
<td>15 31 41</td>
</tr>
<tr>
<td>Baulkham Hills</td>
<td>2 4 8</td>
<td>3 7 20</td>
</tr>
<tr>
<td>Kuring-gai</td>
<td>4 8 13</td>
<td>13 25 33</td>
</tr>
<tr>
<td>Hornsby</td>
<td>5 8 15</td>
<td>10 20 33</td>
</tr>
<tr>
<td>Manly/Warringah</td>
<td>9 18 37</td>
<td>20 42 72</td>
</tr>
</tbody>
</table>

TOTAL 626 842 1061 623 846 1050

Note: Total jobs is greater than resident workers due to commuting from outside the urban area. Workers with variable or unknown workplaces are excluded.


In summary, the trends of the 1950s in Sydney were that employment growth in the city centre, inner and middle suburbs was accompanied by population decline or slow growth, so that local balance improved in these areas, while in the outer suburbs population growth was generally more rapid than employment growth (Table 6.6). These two trends cancelled out,
and on balance two-thirds of all workers could work locally in 1961, the same as in 1945. Unfortunately the 1945 data do not include any assessment of the traffic flows connecting dwellings and workplaces, so it is not possible to calculate the change in response rates. However, with the balance between jobs and dwellings constant and journey lengths increasing the likelihood is that they declined.

Employment growth in Sydney during the 1960s was more widespread than during the previous decade (Table 6.5). The most significant change was that the city centre stopped growing, as it had in Melbourne a decade earlier. However, employment growth continued nearby in North Sydney and in the inner western and southern suburbs. It likewise continued in the established western employment areas, and at last reached the western fringe in places like Fairfield and Blacktown. As in Melbourne this continued decentralisation provided an opportunity for continued urban expansion, particularly in the western suburbs.

In Melbourne during the 1960s the entire pre-war urban area lost population. This was not the case in Sydney, where population declined only in the innermost suburbs. It increased in most of the middle areas, which may be seen as a delayed response to the increase in city centre employment during the 1950s. These population increases raised the density of many of the established suburbs and counter-balanced lower densities on the fringe, thus halting the decline in urban density overall (Table 3.2). Though less than a quarter of the workforce held jobs in the city centre, this was sufficient for some of the changes predicted by the single-centre model to be superimposed on the scattered city.

The net effect of all these changes was to improve local balance through most of Sydney during the 1960s (Table 6.7). Only in Liverpool and Baulkham Hills did population growth run ahead of employment. Response rates declined in all the outer suburbs with two exceptions: Manly/Warringah and Blacktown. The continued high response in the former was associated with continued transport difficulties in crossing Middle Harbour to get to the rest of Sydney. By contrast, a reduced response rate in Sutherland correlated with the building of a new road bridge over the Georges River, which made possible a considerable increase in the number of workers driving to work outside the shire. The continued high response in Blacktown was associated with its continuing severe shortage of local jobs.

The case of Manly/Warringah apart, the reduction in response also correlated with the social status of suburbs. On the
Appendix

High-class, highly motorised North Shore response declined even in the inner areas, but in the other inner and middle suburbs it remained more or less constant.

The general improvement in local balance and the widespread decline in response rates during the 1960s cancelled out in Sydney as in Melbourne. The proportion working locally declined in those suburbs where local balance worsened, and also in major areas of job surplus, but increased elsewhere. During the 1960s, therefore, a decentralisation of employment accompanied by further motorisation made possible an increase in population at constant average journey length.

Table 6.6 Balance between resident workers and jobs, Sydney, 1945-71

<table>
<thead>
<tr>
<th>Region</th>
<th>1945</th>
<th>1961</th>
<th>1971</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sydney/Woollahra/Waverley</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Botany/Randwick</td>
<td>58</td>
<td>80</td>
<td>84</td>
</tr>
<tr>
<td>Inner western suburbs</td>
<td>70</td>
<td>80</td>
<td>88</td>
</tr>
<tr>
<td>Rockdale/Kogarah</td>
<td>29</td>
<td>42</td>
<td>53</td>
</tr>
<tr>
<td>Canterbury/Hurstville</td>
<td>37</td>
<td>45</td>
<td>53</td>
</tr>
<tr>
<td>Sutherland</td>
<td>60</td>
<td>33</td>
<td>50</td>
</tr>
<tr>
<td>Bankstown</td>
<td>100</td>
<td>63</td>
<td>83</td>
</tr>
<tr>
<td>Auburn/Strathfield</td>
<td>94</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Parramatta</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Holroyd</td>
<td>55</td>
<td>37</td>
<td>55</td>
</tr>
<tr>
<td>Fairfield</td>
<td>78</td>
<td>36</td>
<td>48</td>
</tr>
<tr>
<td>Liverpool</td>
<td>100</td>
<td>96</td>
<td>78</td>
</tr>
<tr>
<td>Campbelltown</td>
<td>67</td>
<td>54</td>
<td>64</td>
</tr>
<tr>
<td>Blacktown</td>
<td>73</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td>Penrith</td>
<td>64</td>
<td>60</td>
<td>85</td>
</tr>
<tr>
<td>Inner northern suburbs</td>
<td>34</td>
<td>66</td>
<td>100</td>
</tr>
<tr>
<td>Ryde/Hunters Hill</td>
<td>47</td>
<td>50</td>
<td>68</td>
</tr>
<tr>
<td>Baulkham Hills</td>
<td>64</td>
<td>48</td>
<td>40</td>
</tr>
<tr>
<td>Kuring-gai</td>
<td>34</td>
<td>33</td>
<td>39</td>
</tr>
<tr>
<td>Hornsby</td>
<td>55</td>
<td>37</td>
<td>55</td>
</tr>
<tr>
<td>Manly/Warringah</td>
<td>46</td>
<td>42</td>
<td>51</td>
</tr>
</tbody>
</table>

OVERALL 67 66 71

Table 6.7 Residents working in the same region, Sydney, 1961 and 1971

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sydney/Woollahra/Waverley</td>
<td>83</td>
<td>79</td>
<td>83</td>
<td>79</td>
</tr>
<tr>
<td>Botany/Randwick</td>
<td>38</td>
<td>38</td>
<td>47</td>
<td>47</td>
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<tr>
<td>Inner western suburbs</td>
<td>38</td>
<td>39</td>
<td>47</td>
<td>45</td>
</tr>
<tr>
<td>Rockdale/Kogarah</td>
<td>22</td>
<td>26</td>
<td>51</td>
<td>49</td>
</tr>
<tr>
<td>Canterbury/Hurstville</td>
<td>22</td>
<td>26</td>
<td>47</td>
<td>48</td>
</tr>
<tr>
<td>Sutherland</td>
<td>30</td>
<td>39</td>
<td>91</td>
<td>78</td>
</tr>
<tr>
<td>Bankstown</td>
<td>29</td>
<td>36</td>
<td>46</td>
<td>44</td>
</tr>
<tr>
<td>Auburn/Strathfield</td>
<td>39</td>
<td>36</td>
<td>39</td>
<td>37</td>
</tr>
<tr>
<td>Parramatta</td>
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<td>34</td>
<td>37</td>
<td>34</td>
</tr>
<tr>
<td>Holroyd</td>
<td>17</td>
<td>18</td>
<td>46</td>
<td>33</td>
</tr>
<tr>
<td>Fairfield</td>
<td>20</td>
<td>25</td>
<td>57</td>
<td>53</td>
</tr>
<tr>
<td>Liverpool</td>
<td>52</td>
<td>40</td>
<td>54</td>
<td>51</td>
</tr>
<tr>
<td>Campbelltown</td>
<td>41</td>
<td>40</td>
<td>77</td>
<td>63</td>
</tr>
<tr>
<td>Blacktown</td>
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<td>27</td>
<td>65</td>
<td>64</td>
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<tr>
<td>Penrith</td>
<td>42</td>
<td>54</td>
<td>69</td>
<td>64</td>
</tr>
<tr>
<td>Inner northern suburbs</td>
<td>36</td>
<td>42</td>
<td>54</td>
<td>42</td>
</tr>
<tr>
<td>Ryde/Hunters Hill</td>
<td>27</td>
<td>30</td>
<td>55</td>
<td>44</td>
</tr>
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<td>Baulkham Hills</td>
<td>33</td>
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<td>Kuring-gai</td>
<td>20</td>
<td>20</td>
<td>61</td>
<td>50</td>
</tr>
<tr>
<td>Hornsby</td>
<td>17</td>
<td>18</td>
<td>46</td>
<td>33</td>
</tr>
<tr>
<td>Manly/Warringah</td>
<td>39</td>
<td>46</td>
<td>91</td>
<td>89</td>
</tr>
<tr>
<td><strong>OVERALL</strong></td>
<td>39</td>
<td>38</td>
<td>59</td>
<td>53</td>
</tr>
</tbody>
</table>

Source: Census Journey to Work tables.
APPENDIX

Map 6.1 Local balance, Melbourne 1951.

Percentage of residents able to work locally

0
40
70
100

See Table 9.15
Map 6.2 Local balance, Sydney 1945.

Percentage able to work locally

See Table 9.19
APPENDIX

Map 6.3 Change in local balance, Melbourne 1951-1961.

See Table 9.15

Increased proportion able to work locally
Little change
Reduced proportion able to work locally
Map 6.4 Change in local balance, Melbourne 1961-1971

- Increased proportion able to work locally
- Little change
- Reduced proportion able to work locally

See Table 9.17
APPENDIX

Map 6.5 Local balance, Melbourne 1971.

Percent able to work locally

0
40
70
100

See Table 9.17

- Increase by over 5 per cent
- Little change
- Fall 5 - 14 per cent
- Fall 15 per cent and over

See Table 9.17
APPENDIX

Map 6.7 Change in local balance, Sydney 1945-1961.

See Table 9.19

See Table 9.19
APPENDIX

Map 6.9 Change in response rates, Sydney 1961-1971

Little change
Fall 5 - 14 per cent
Fall 15 per cent and over

See Table 9.20
Map 6.10  Response rates, Sydney 1971

See Table 9.20
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