TWENTIETH-CENTURY TRANSPORT REVOLUTION*

By Derek H. Aldcroft

MUCH of the work of transport historians has been concerned with the eighteenth and nineteenth centuries with particular emphasis on the revolutions which occurred in water and rail transport. Few have ventured seriously into the twentieth century yet transport changes since the turn of the century, and especially since the end of the First World War, have probably been more momentous and far-reaching than any that occurred in the whole of the previous two centuries. They have in turn created severe economic and social problems for society.

DIMENSIONS OF CHANGE

There are several interrelated features of the twentieth-century transport revolution:

1. The enormous growth in the use of transportation services and the consequent increase of the size of the transport sector of the economy.

2. The change in importance of different modes.

3. Significant technological changes which have affected nearly all modes.

1. Growth in the use of transport has come about largely through the rapid increase in personal movement since expansion in freight transport has kept in step with the growth of GDP. People today are moving around much more than they did before the First World War and much of this increased movement can be attributed to the advent of the motor car. For example, in 1914 the typical American averaged about 1640 miles of total travel per year, and nearly 1300 of this was accounted for by walking. In other words, he travelled only about 340 miles per year with the aid of horse, cycle or mechanical means and in a lifetime he might cover a distance of some 89,000 miles (based on a life expectancy of 54 years). By the late 1960s the average American car owner drove 10,000 miles per year and many Americans can hope to notch up 3 million miles in a lifetime, or more than thirty times the log of his counterpart in 1914. The absolute figures are impressive. In 1967, 108 million Americans made 360 million

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trips involving an overnight stay more than 100 miles from home and these trips alone accounted for 312,000 million passenger miles. Passenger miles travelled within the United States have been increasing at a rate six times faster than the population for at least 25 years.[1] Most other developed countries, and not a few underdeveloped ones, have experienced a similar process even though less dramatic than that of the United States. In the U.K., for instance, the number of passenger miles travelled per capita between 1950 and 1970 more than doubled, at a rate of just over four per cent compound per annum compared with an annual increase in GDP per year of 2.8 per cent. This calculation excludes external air travel which has grown very rapidly since the war. Freight transport has also expanded but in most cases it has grown *pari passu* with the expansion in domestic output.

As a result of this expansion the transport sector has been absorbing a growing share of national resources, especially since the Second World War. In Australia, for example, personal expenditure on transport (including the purchase and operation of private motor vehicles) as a proportion of total consumers' expenditure has increased from 8.59 per cent in 1948/9 to 13.72 per cent in 1971/2, while in the U.K. it increased from 5.95 to 11.79 per cent between 1946 and 1970.[2] The transport sector's share in personal consumption in the United States has grown less dramatically since the war probably because it was already fairly large at the beginning of the period. In 1971 it accounted for 13.55 per cent of total personal consumption as against 12.93 per cent in 1950.[3] Expenditure on transport now forms one of the largest items in personal consumption after food, and in some cases probably exceeds that on housing.

The size of the transport sector is of course larger than these figures imply since they do not include expenditure on freight transport and investment in transport equipment including infrastructures, that is roads, docks and airports. There are difficulties in deriving an exact tally in this respect partly because of the nature of the data and the problems of double counting and also because of the definitional problems regarding what constitutes the transport sector. But a number of recent and fairly comprehensive estimates suggest that the transport sector accounts for around 10 per cent of the national income and possibly considerably more.[4] Estimates for the U.K. which include all current and capital expenditures on all forms of transport (including roads, docks etc.) other than sea freight and excluding the purchase of new vehicles (depreciation of vehicles included instead) indicate that by 1969 transport expenditures

[1] These figures are taken from A. Toffler, *Future Shock* (1972), pp. 76-7.

[2] D. H. Aldcroft, *Studies in Transport History, 1870-1970* (1974), pp. 263-5, 273. Commonwealth Bureau of Census and Statistics of Australia, *National Income and Expenditure,* 1963/4, p. 51 and 1971/2, p. 52.

[3] U.S. Bureau of Census, *Statistical Abstract of the United States 1973*, p. 322.

[4] J. Child, "Transport and the Economy", in *Policy in Transport in New Zealand,* ed. M. R. Palmer (1973), p. 322.

accounted for over 20 per cent of gross domestic expenditure compared with under 16 per cent in 1954.[5] Though these estimates are subject to margins of error it is clear that transport has been anything but a stagnant sector in the post-war period. There is little doubt that it has expanded both absolutely and relatively and at the same time there has been a significant shift in preferences for different modes together with revolutionary changes in methods of movement.

2. The second major feature of change has been the dramatic shift in modal choice, especially on the passenger side. The development of two new forms of transport, motor transport and aviation, have largely been responsible for this. Before 1914 these were very much in the experimental stage and between the wars they were applied on a moderate scale, motor transport more so than aviation, But their massive application with respect to passenger movement was to come after the Second World War. As far as inland transport is concerned this involved not only a shift in modal choice but also a switch from public to private transport. In the immediate post-war years public transport (road and rail) was still the dominant supplier of passenger services; thereafter the private car swept all before it and by the 1960s it had become the major means of personal conveyance. Thus in the United Kingdom passenger miles travelled per capita on public transport fell by nearly 50 per cent between 1950 and 1970 but rose some six times for the private car. By the latter date private transport accounted for around three-quarters of the total passenger movement within the U.K. as against only one-quarter in 1950.[6] The penetration of private transport has been even deeper elsewhere. In Australia private transport now provides about 85 per cent of total personal mobility in cities, while in the United States over 90 per cent of all passenger miles accumulated each year is attributable to automobiles.[7] Within the public sector both rail and bus transport have been adversely affected by the growth of car ownership.

A similar revolution has taken place in international passenger transport. Air travel has eclipsed that by sea but in contrast to inland services this has involved a shift away from private towards public transport, since the majority of airline services are provided by publicly owned corporations whereas most sea transport is still controlled by private enterprise. Before the war air transport was still only a marginal supplier in terms of passenger movement between countries and it continued to be so until the 1950s. That decade saw a very rapid growth in air travel and by the end of the 1950s it was overhauling shipping services on long-distance sea routes such as the North Atlantic. By the late 1960s air transport dominated inter-country passenger services, especially on

[5] D. H. Aldcroft, *British Transport, 1914-1973* (1975).

[6] Ibid.

[7] N. Clark, "Economic, Social and Financial Problems of Urban Public Transport in Australia", *Transportation, Planning and Technology*, No. 3 (1974); OECD, *Future Directions for Research in Urban Transportation* (1969), pp. 80-1.

long-distance routes. In 1970 it accounted for two-thirds of the external passenger traffic to and from the U.K., and this may be regarded as a relatively low proportion because of the relatively large amount of cross-channel ferry traffic to the continent of Europe which still prevails.[8] The proportion for New Zealand, for example, a country with no close neighbours, was 89 per cent.[9]

On the freight side the trend in development has been similar though less dramatic than in the case of passenger transport. Road transport has steadily penetrated the inland freight market at the expense of other forms of transport. This is particularly so in the case of Britain where by 1970 road hauliers accounted for 61 per cent of all freight movement measured in terms of ton-miles. The railways and coastal shipping still remain important suppliers of freight services for certain categories of heavy commodities, while pipelines are beginning to make an indent on the market for liquefied products. British experience, however, is not necessarily a very good guide to developments elsewhere given the greater preponderance of long hauls of bulk goods in other countries. Road haulage accounts for less than one-quarter of the inter-city freight traffic in America while oil pipelines are equally important; most of the remaining traffic is moved by the railways and waterways.[10] In Australia road transport is even less important, accounting for under 20 per cent of the total freight movement. Here sea transport predominates with over 50 per cent while rail absorbs 28 per cent (1970/71). Moreover, sea and rail freight movements have expanded more rapidly than road transport since the middle of the 1950s.[11] On the other hand, in terms of tons carried road transport is responsible for around three-quarters of the freight market.[12]

By contrast there has been very little change in the modal split in the international freight market where water crossings are involved. Here the market is still dominated by shipping though air transport has become in recent years an important marginal supplier of services especially for valuable commodities of low bulk and weight.

3. Most forms of transport have experienced rapid technological change since the First World War, and even more so since the Second. Between the wars the size and efficiency of aircraft increased considerably, the motor vehicle was developing into an efficient machine, electric and diesel traction were being applied on the railways, while shipping was shifting over to oil as a fuel.

[8] See *Annual Abstract of Statistics, 1971.*

[9] A. E. McQueen, "Passenger Transport: Review and Prospect", in Palmer, ed., op. cit., p. 44.

[10] U.S. Bureau of Census, *Statistical Abstract of the United States 1973*, p. 537.

[11] The predominance of sea transport *vis-à-vis* road transport is a reflection of the very large difference in the average length of haul between the two modes: 1261 as against 21 miles. K. T. Solomon, "Roads and Road Use in Australia, Statistical Summary 1970", *Australian Road Research*, V (April 1973), pp. 17, 28; National Association of Australian State Road Authorities, *Concepts and Procedures: A Study of the Economics of Road Vehicle Limits.* Study Team Report (July 1974), p. 7.

[12] Solomon, op. cit., p. 29.

Developments since the war have probably been even more dramatic and spectacular except possibly in the field of motor transport, which is somewhat ironic given the fact that it now monopolizes surface transportation. The massive application of diesel and electric traction has rendered steam traction virtually a thing of the past on the railways. In air and sea transport the most noticeable developments have been the great increase in the size and speed of craft used. This is especially the case in air transport while in shipping there has been a tremendous increase in the size of vessels together with the completion of the shift to oil as a fuel.[13] The most dramatic increase has been in tankers; in 1939 most tankers had a capacity of 10,000 to 12,000 deadweight tons, and supertankers about 16,000 tons. Thirty years later the latter were regarded as uneconomic, tankers of 60,000 tons were in common use and much of the new construction involved supertankers in the range 150-300,000 deadweight tons.[14]

TRANSPORT PROBLEMS IN PERSPECTIVE

Most people are fairly familiar with the more obvious contemporary transport problems. Questions such as congestion, pollution and other environmental problems and the deterioration of public transport services are a frequent source of comment. Yet many of today's problems do have an historical counterpart. Street congestion, for example, was by no means unfamiliar to the Victorians and indeed it can be traced back through Elizabethan times to antiquity. For centuries it was a source of complaint in London while early sixteenth-century planners in Paris issued dire warnings of the paralysis likely to ensue from the growth in street traffic.[15] Horse transport also proved to be something of a pollution hazard in larger cities during the nineteenth century. The noise, stench and filth arising from the liberal use of horses in city streets proved to be almost as obnoxious and detrimental to public health as the motor car today. Places as far apart as London and Sydney were subject to the same abuse. Blainey, writing in the context of nineteenth-century Australian cities, notes that "So long as thousands of horses drew vehicles through city streets, mounds of manure lay on the roadways and gutters and in the laneway stables; horses were as detrimental to public health as the exhaust fumes which replaced them as the distinctive scent of cities. So long as a city mainly used horses its backyard gardens were fertilized with manure and its kitchen windows swarmed with flies".[16] Indeed, the problem had become so serious towards the end of the

[13] In 1914 oil-burning steamships and motorships comprised only 3.4 per cent of the world's non-sail tonnage; by 1939 this had risen to 54.7 per cent and by 1961 to almost 96 per cent.

[14] R. W. Barsness, "Maritime Activity and Port Development in the United States since 1900: A Survey", *Journal of Transport History*, II (1974), p. 174.

[15] S. Plowden, *Towns Against Traffic* (1972), p. 11.

[16] G. Blainey, *The Tyranny of Distance* (1966), p. 295. For a graphic description of London's "horse" problem in 1890 see Jane Jacobs, *The Death and Life of Great American Cities* (1962), pp. 341-2.

century that sanitary engineers even regarded the introduction of the motor vehicle as a possible solution to the question of city hygiene, and one which would also help to relieve congestion![17]

In a wider social context one can argue that the social disturbance and visual intrusion caused by the motor car, extensive highway building and, to a lesser extent, by the development of air transport facilities in the present century may be compared with similar characteristics of railway development in the nineteenth century. The noise and fumes created by the "iron horse" attracted more than the occasional comment, while the residential upheaval caused by the railways would, in today's climate of opinion, have aroused serious social concern. Kellett has shown how the railways dissected and intersected some of Britain's great cities and the problems and social costs involved for those unfortunate enough to get in their way.[18] The process by which the poorer sections of the community were displaced to make way for the railway is now being repeated as highways carve up the less affluent residential districts.

Clearly many of the present-day problems associated with transport have either their origins way back in time or else they have a historical counterpart of some kind. The failure to appreciate this fact fully probably leads us to exaggerate our current anxieties about transport. Alternatively, the greater mobility of our age and the expectations which one has with regard to travel probably leave one with a feeling of dissatisfaction about the state of affairs as they exist, while any deterioration in standards, which necessarily restricts the degree of social intercourse, is immediately viewed with alarm. Thus the fact that the speed of travel within the central zones of cities is very little different now compared with that in the horse-drawn age can be regarded either as a serious deterioration in standards relative to modern expectations about mobility[19] or else it can be invoked in support of a claim that conditions have at least not got any worse than they were in the nineteenth century. That said therefore, anyone who is "romantic" enough to advocate a return to horse transport must be prepared to assess both the benefits and costs of that type of travel *vis-à-vis* those arising from motor transport.

Estimation of relative scales between one system and another is not easy, but even in the absence of formal measurement most people are probably convinced in their own minds that the magnitude of twentieth-century transport

[17] P. S. Bagwell, *The Transport Revolution from 1770* (1974), pp. 221-2.

[18] J. R. Kellett, *The Impact of Railways Upon Victorian Cities* (1969).

[19] As the introductory statement to the OECD report on *Urban Transportation* points out, urban congestion is not a new phenomenon but it is only recently that obstacles to mobility have begun to present a pressing social problem: and for the simple reason that to the modern urban dweller mobility has become a crucial factor in the enjoyment of life so that any impairment of the ability to move freely becomes a serious constraint on his capacity to partake in the social and economic advantages of the city. OECD, *Future Directions for Research in Urban Transportation* (1969), p. 15.

problems is of a quite different order from those of the nineteenth century. The vast increase in the amount of travel since the turn of the century coupled with significant shifts in modal preferences and technological changes has seriously aggravated old problems as well as having created new ones. The widespread use of the motor car in particular, while not the only source of transport problems, is certainly the major issue of debate in this context. It should be noted moreover that it is in the high-income countries of Europe, North America and Oceania, where car ownership is widespread, that the problems are really acute. In 1967 these three areas accounted for 90 per cent of world car ownership. Elsewhere—in Eastern Europe and the Soviet Union, Latin America and Asia—the level of automobile ownership is so low by comparison as to cause little real concern as yet.[20]

There are many different aspects of the transport problem which merit attention though obviously they cannot all be discussed in depth in this paper. Attention will be focused on two broad issues, namely the utilization of resources and the urban transport problem, with passing reference to the environmental and social implications of modern transportation developments. The latter aspects are by no means of least importance but to do proper justice to them would require a much lengthier study.

UTILIZATION OF RESOURCES

Modern transport developments have put heavy pressure on resources, especially land, capital and fuel. In all three cases transport is using up resources at an alarming rate. The widespread use of motor transport has been critical in all three respects though it is not the only factor; both air and sea transport, for instance, have absorbed large amounts of land and capital, especially with regard to the provision of infrastructures.

Consumption of oil is already high and growing rapidly. A large part of this consumption is absorbed by transport. As with coal in the past, it has been wastefully used largely because of abundant and cheap supplies, at least until recently. If anything the return from the energy expended on transportation has decreased during the course of the twentieth century. In the early nineteenth century the average American spent 2000 calories per day for speeds of four miles per hour, rising to 3200 calories per day to move 20 miles per hour by the early twentieth century. By the late 1960s some 12,000 calories per day were required to cross cities at an average speed of 25 miles per hour and as little as 7-10 miles per hour in the centre of cities.[21] The recent sharp rise

[20] For data on car use in various regions of the world see A. Silbertson, "Automobile Use in East and West", *Journal of Transport Economics and Policy*, IV (1970), p. 8; United Nations, *Transport Modes and Technologies for Development* (1970), p. 117.

[21] C. C. Kissling and D. C. Johnston, "Transportation, Society and Environment", in Palmer, op. cit., p. 86.

in oil prices coupled with the long-term possibility of the exhaustion of world oil reserves has added a new dimension to this problem.

The pressure on land is already acute in urban areas. The amount of land required for each additional increment to a city's population has grown rapidly since the turn of the century. At that time for every 1000 new inhabitants added to a city's population the city's size expanded by about 10 additional acres. By 1930 cities required 30 new acres per 1000 people while currently they absorb 200 acres for each additional 1000 increment to the population.[22] These data refer to American experience but there is every reason to suppose that the same process has been taking place in other high-income countries. Blumenfeld suggests that in the large metropolitan areas of North America and Western Europe absorption of land for urban purposes has been increasing at approximately the square of the population increase.[23] Much of this increase can be attributed to the fact that car ownership has risen faster than the population and hence an ever-increasing proportion of land has been devoted to highway development.[24] At the same time the spread of car ownership has led to more extensive development at the urban margin and hence raised the amount of land required for residential and other purposes. In addition, modern airports and docking installations have consumed large tracts of land. Quite often some of the best farmland has been pre-empted for such purposes.

It is difficult to calculate precisely the amount of land used for transport of all kinds in cities. One estimate suggests that approximately 28 per cent of urban land in North America is used for urban transport, excluding land for car parking.[25] For some cities the proportion is much higher. Creighton quotes figures as high as 35-40 per cent of the total amount of urban land required for all forms of movement in selected cities, namely Chicago, Pittsburgh and Niagara Frontier. Most of this is absorbed by road space, and all other forms of transport—airports, railways, ports and terminals—account for 6-10 per cent of the total land area.[26] The amount of land devoted to such uses is probably lower in European cities though few estimates are available as yet. Data collected by Smeed for a number of British and European cities suggest that the proportion of the ground in town centres used for carriageways varies from between 10 and 21 per cent. Earlier and more comprehensive figures for the

[22] R. A. Buel, *Dead End: The Automobile in Mass Transportation* (1972), p. 157.

[23] H. Blumenfeld, "Criteria for Transport Planning", in OECD, *Future Directions for Research in Urban Transportation* (1969), p. 98.

[24] In the case of America paved roads and streets have been added at the rate of more than 200 miles a day for the last 20 years, which adds up to 75,000 miles of new roadway every year, enough to girdle the globe three times. During this period road mileage increased by 100 per cent compared with a population increase of 38.5 per cent. Toffler, op. cit., p. 77.

[25] E. H. Holmes, "Highway Transportation", in National Academy of Sciences, National Research Council, *U.S. Transportation Resources, Performance and Problems* (1961. Washington D.C.), p. 13.

[26] R. L. Creighton, *Urban Transportation Planning* (1970), pp. 67-8.

London Metropolitan Boroughs show that roads and footways and railways accounted for about 22 per cent of the land area.[27]

For a country as a whole the proportion of land absorbed by transport facilities of one form or another is very small.[28] However, the crucial point is that in the major urban areas the share is high and growing all the time, but the quantity of land available is finite with the result that there is obviously a limit to the satisfaction of specific demands. In such areas there are strong competing claims for housing, office building and commercial premises etc. Thus it is not simply a question of whether we can afford new transport facilities but rather whether there is enough land on which to build them. The critical factor therefore is what proportion of urban land should be devoted to transport and how one determines the optimal amount.

A similar problem is raised with investment. Possibly 15 per cent or more of the capital resources of developed nations is tied up in transport and transport absorbs a large share of current investment. In the U.K. for example some 17 per cent of all investment is accounted for by this sector (excluding private cars). This proportion could increase further if transport projects to meet the demands of the future in urban areas are allowed to go through, e.g. the London and Sydney plans. Since transport absorbs such a large share of a nation's capital resources there are clearly some very important allocation problems to be solved. Moreover, it is not simply a question of the allocation between transport and other sectors of the economy since within the transport sector itself there is the problem of allocating investment resources between competing modes, e.g. road versus rail, public versus private transport. Furthermore, there is the question as to whether the taxable capacity of the community is great enough to finance the grandiose schemes envisaged in some of the city transportation studies.

Both with respect to land and investment the critical problem is one of allocation of scarce resources. There are three possible routes by which the allocation problem might be solved: (1) the free market mechanism; (2) the use of economic analysis to determine the optimal allocation—mainly cost-benefit analysis; (3) arbitrary political decisions determined partly by pressure of vested interests, by prestige considerations etc.

All three can produce strange results and this may be because they are not mutually exclusive, in that the system is a mixed one. It is true that there is not much left of the free market in transport now and certain areas such as

[27] R. J. Smeed, "Traffic Studies and Urban Congestion", *Journal of Transport Economics and Policy*, II (1968), p. 63; and "The Space Requirements for Traffic in Towns", in *Urban Survival and Traffic*, ed. T. E. H. Williams (1961), p. 140. I should like to thank Professor Smeed for drawing my attention to his work on transportation land use.

[28] R. J. Smeed, "The Traffic Problem in Towns", *The Town Planning Review*, XXXV (1964), pp. 5-6.

roads have never operated under a pricing system. It is possible that the best solution might be the free market if the pricing system were allowed to operate with safeguards in terms of compensation for the victims. But the present mixed system produces far from satisfactory results and at the same time there is limited compensation for the victims. For example, the development of Concorde and the Channel Tunnel—which may be regarded as arbitrary political decisions partly for prestige purposes. The Melbourne underground railway project falls into much the same category. The authorities never made any close study of its likely impact nor did they attempt to consider seriously any feasible alternatives.[29]

In the last decade or so cost-benefit analysis has been applied widely to transport investment projects as well as to others. But this method of arriving at a solution is subject to severe limitations and the conclusions of such studies may often be overridden by political decisions. Apart from anything else the weight of work required to determine the optimal solution in any particular instance can rarely be carried out in full. Most of the studies remain incomplete and many of the benefits amount to no more than guesswork. In any case, in the absence of a system of market prices the determination of many costs and benefits is often made in an arbitrary manner. The problem regarding the siting of the third London airport provides a good illustration of these points. After long debate and several committees had considered the issue a full-scale Royal Commission (Roskill) was set up to inquire into the matter. This Commission took evidence from numerous sources and carried out extensive analysis and eventually produced nearly a dozen volumes of material. The Commission came down in favour of the airport being located at Cublington but this was only the best in terms of four sites investigated in depth (there may well have been many other possible sites which were better) and then only in terms of the valuation yardsticks used for measuring the intangibles in this particular instance. Had a different set of yardsticks been chosen and weighted in a different manner it is quite conceivable that the results would have been rather different. But after this expensive exercise the Government of the day finally selected the costliest location, Foulness, a choice which seemed to accord more closely with popular opinion and environmental considerations, but which could have been made without mounting such a massive inquiry. As the *Financial Times* remarked: "After all the cost-benefit analysis possible is brought to bear, the final choice must be a political one based on hunch. The Government's hunch has led it to support the popular preference for Foulness."[30]

[29] An independent inquiry came to the conclusion that the contribution of the underground line would result in a serious misallocation of resources. N. Clark, I. Richards and K. W. Ogden, "Analysis of the Proposed Melbourne Underground Railways" in *Analysis of Urban Development Tewksbury Symposium*, ed. N. Clark (1970).

[30] *Financial Times*, 27 April 1971.

Choices derived under routes (2) and (3) raise further problems. Not only may they lead to resource misallocation but they probably strike against the principle of equity. By taking the decisions out of the market some consumers are subsidized and often it is the richer sections of the community which benefit most. For example, nearly all airline travellers are subsidized in one way or another because pricing systems do not reflect true costs. Airport costs in particular are not cleared through the market, while the research and development expenditures on new aircraft are subsidized in one way or another—the most blatant example is of course Concorde. The Channel Tunnel probably falls into the same category, while road users are probably not paying the full costs of the services provided for them. The financing of such projects may also be regressive.

Frequently therefore it is the richer sections of the community which stand to benefit most from new transportation projects while at the same time they incur the least costs. This is certainly the case with air travel but it frequently crops up with road and rail transport. In many North American cities, for example, it has been found that it is often the disadvantaged minority groups who benefit least from actual systems operations yet stand the greatest environmental sacrifices because they are the cheapest element to displace and are least capable politically of presenting their collective point of view. Highway structures disrupt neighbourhoods, spoil surroundings and intrude on human activities but the section of the community enjoying the most from the on-systems benefits in the form of better roads probably suffers the least environmental costs (compare with railways in the nineteenth century). Similarly, mass transit facilities are often built to serve those least in need with subsidies from the poorer sections of the community. For example, the opening of the swift rail line in Chicago (1964) connecting the village of Skokie with downtown Chicago and subsidized by the Federal Government and the Chicago Transit Authority serves a ridership consisting of households 86 per cent of which own one car and 33 per cent of which own two or more, the proportions for the whole Chicago area being 72 and 15.3 per cent respectively.[31]

THE URBAN TRANSPORT PROBLEM

The urban transport problem is the one that has attracted most attention and it is also the one that has proved the most difficult to solve. This is not surprising since the daily travel effort affects most people. For the most part this problem is associated with the development of private transport and the concomitant decline or deterioration in public transport facilities.

Initially the development of motoring eased the problem of travel to some extent by reducing trip times and relieving congestion in city centres. But the

[31] Buel, op. cit., p. 150.

massive application of this new form of transport created its own barriers to mobility. It allowed a considerable enlargement of city size which partly cancelled out the gains from improved speeds, while mounting congestion and implementation of traffic controls eventually reduced the speed of cars to that of the bicycle and hansom cab. In effect, therefore, increased travelling time has destroyed many of the benefits associated with shorter working hours. The average working week declined from between 50 and 60 hours before 1914 to about 40 in 1970 but, allowing for travelling and other wastes of time, the average working person still spends some 55 to 60 hours per week away from home. Perhaps, as Mossé suggests, real progress is now more a question of reducing travel time than of further increasing productivity at work.[32]

The main difficulty is the peak travel problem which puts enormous pressure on existing facilities for part of the day, after which they are badly underutilized, though in many cities there are several peak flows during the course of a day. Flows of traffic on commuter networks at peak periods are many times the average. For many mass transit facilities 80 per cent of the traffic volume is concentrated in 20 hours of the week, with heavy concentrations in space as well as time.[33] This leads to a very uneconomic use of resources. The average load factor of public transport systems in cities is probably less than 25 per cent. Private transport facilities are used even less. The typical car is used less than 10 per cent of the time and the space within it is less than 25 per cent utilized when it is in operation. Low utilization rates are also characteristic of roads, parking lots and city streets.[34]

The peak problem defies a complete solution. It cannot be solved simply by building more roads to cater for the traffic since this is very uneconomic; the costs are probably beyond the taxable capacity of the community, it is wasteful of urban space and adds to the pollution problems. It also raises the question of equity and conflicts with public transport systems.

One solution to the peak problem is public transport and here there are two main alternatives, rail and buses. Rail transit is well suited to dealing with large and dense traffic flows; railways are cheaper to build than motorways and they do not involve heavy external costs. But they are relatively uneconomic to provide for peak travel requirements given the very low off-peak demand. Provision of such facilities may also aggravate the peak problem. Also rail transit is very inflexible simply because it is difficult to adjust facilities to geographic shifts in demand. Buses are much more flexible and involve lower capital than railways, while they use urban space more efficiently than private

[32] R. Mossé, "An Introduction to Urban Transportation Problems", in *Transport and the Urban Environment*, ed. J. G. Rothenberg and I. G. Heggie (1974), p. 149.

[33] H. W. Richardson, *Urban Economics* (1971).

[34] Buel, op. cit., p. 24.

cars. But again there is the peak problem which leads to uneconomic operation for the rest of the time.

The question of uneconomic use apart, there is the problem of modal choice between private and public transport, which favours the former since the consumer when selecting his mode of travel pays attention only to private costs and benefits, which can differ substantially from social costs and benefits. Furthermore, the private car traveller does not take account of the full private costs of car travel. This results in a high income-elasticity of demand for private car services and a low elasticity for public transport. In the United States it has been found that a one per cent increase in family income will reduce on average that family's use of rail transport by 0.6 per cent, whereas the income-elasticity of demand for cars is +1.2 per cent.[35] In general individuals buy a car as soon as they can afford one and then use it irrespective of relative costs. On the other hand, the quality of public transport does affect the use made of cars, especially by commuters, since the private-public transport trade-off is relatively responsive to changes in fares, relative travel times, comfort and convenience. Hence once the switch is made the relative unattractiveness of public transport becomes more noticeable and as the number of car travellers grows there is a positive feedback effect. For example, more car travellers means fewer bus passengers and increasing street congestion, which in turn leads to higher fares and a deterioration in the quality of service offered by operators. And as the quality of service declines so the substitution effect accelerates. What is even more depressing is that once passengers are lost to public transport there is little likelihood of their ever returning whatever the inducements offered. Surveys of travellers suggest that they would be unresponsive to improvements in public transport services in terms of faster travel times, reduced fares or better frequencies. Even the prospects of a free bus system attracted few potential transfers.[36] The fact is that public transport has acquired a poor image over the years and is rapidly being regarded as the mode of travel for the poor, the sick, children and elderly people.

This may be taking an unduly pessimistic view of the prospects and it could be that the preference for private transport is a product of the system itself. Buel suggests that many U.S. citizens cannot or do not choose to drive their own vehicles and many would prefer public transport if it were as good. If these preferences are correct why then are they not reflected in choice? He

[35] Buel, op. cit., p. 159.

[36] See D. A. Quarmby, "Choice of Travel Mode for Journey to Work", *Journal of Transport Economics and Policy*, I (1967). However, a survey of 400 regular London car commuters in 1965 suggested that the response transfer rate given an improvement in service and a reduction in fares on public transport was somewhat greater. But there was an upper limit to the price elasticity; at a zero fare 51 per cent of the commuters would have been prepared to switch to public transport. Penelope M. Williams, "Low Fares and the Urban Transport Problem", *Urban Studies*, VI (1969).

maintains that this is because there is no democratic free market system in which people can get what they want. The major decisions about urban transportation are made by very large institutions, including financial, commercial and governmental, which are managed and manipulated by the industrial system. The effect of this has been to cater for the private motorist at the expense of the rest of the community, and possibly at the expense of many motorists themselves. At this point for most people to give up their cars would be a major economic sacrifice since only 14 cities have electric rail systems and many bus networks have deteriorated to a point where they are totally inadequate.[37]

In these circumstances it is difficult to conceive that public transport can attract back traffic unless restrictions are placed on the use of personal transport. There are several possible ways in which this could be achieved.

Allow congestion to choke off demand and thereby encourage a shift to other modes of transport. There is something to be said for this since it is a form of progressive taxation, the major incidence falling on the higher income groups. However, the net result is that everyone is likely to be worse off since public transport services suffer from congestion effects. In any case this does nothing to solve the peak problem.

Price rationing; that is, a surcharge on peak users of transport facilities which would have to apply to both public and private transport. This of course would hit low income earners severely. Moreover, the attempts to deal with peaks in both sectors in this way may be self-defeating in that surcharges on public transport would simply drive more people over to car use. Alternatively the pricing system could be used to discriminate against the use of the private car in urban areas during peak periods. Various methods could be applied, including metering, higher parking charges, fuel taxation. There is certainly a case for charging private cars the full costs they create at peak hours and for valuable parking space. If this is not sufficient to reduce the problem, or if the administrative task is too difficult, then the best solution would be to resort to physical restriction by permits or freeing the central zones of cities entirely from personal traffic.

Once this is done there would then be more resources to shift into public transport, which could be improved for the benefit of everyone. The peak problem would remain for public transport operators. One solution would be to stagger daily movements, though this is very hard to implement in practice. Peak surcharges could be used to drive away those customers who can avoid the busy periods with compensation to those that cannot. Another alternative is to subsidize public transport as at present but there is no justification for excessive subsidization so that fares remain below normal cost, that is below what they would be, given a fairly even distribution of demand. The economic

[37] Buel, op. cit., pp. 160-1.

problem of public service operators could be alleviated by attracting more traffic in the off-peak periods and this might be done by offering lower fares. However, at such times public transport would have to compete with private conveyance; also in practice such systems have been used but the time limits tend to be so restrictive that custom is not easily accommodated. Moreover, it is not clear that there is all that much additional traffic to attract within the specified off-peak period.

The problem of the congestion peak may be easier to solve than many studies would seem to suggest. One defect of some of the transportation studies is that they start out with a negative approach and assume a continuing and absolute decline in public transport patronage and hence public transport is conceived largely in terms of a residual provision mainly for the impoverished and incapacitated. This not only leads to a further deterioration in the cost and quality of services offered, which incidentally strikes against equity principles, but it also adds to the congestion problem by encouraging a further switch to private transport. Alternatively, a passive policy of trying to attract commuters to the system is much less likely to be effective than an active policy of repelling people away from private car use by directly manipulating the facilities enjoyed by "own car" commuters. As the authors of the survey into Brisbane's peak period work journeys point out, virtually any desired modal shift can be effected given a sufficiently large absolute deterioration in the relative cost/quality position of "own car" use. They argue that the most feasible solution, and one that would be fairly easy to implement, would be a tripartite policy of very low or zero public transport fares, a large increase in parking fees and the provision of express services. With the right policy mix it should be possible to induce 50 per cent or more of motorists to switch to public transport. Whether in fact this would represent the best solution in economic terms is an open question but it appears evident that there is no insuperable barrier to achieving a shift in modal choice. Moreover, the study also reveals a rather limited willingness on the part of respondents to the survey to pay for time savings. As far as public service patrons are concerned timetable factors, safety and cost considerations are accorded higher priority than trip times. This finding is of particular interest in so far as it casts doubt upon the validity of the weighting given to the quantification of time savings benefits relative to other factors in many transportation studies.[38]

Whatever scheme is adopted there will probably be difficulties in the way of acceptance and its administration. But it will soon be essential to take drastic action to reduce the use of cars in cities since the waste of resources in allowing

[38] L. A. Duhs and M. J. Gibbins, *An Enquiry into Modal Choice in Brisbane's Passenger Transport: An Investigation of Peak-period Work Journeys* (Department of Economics, University of Queensland, 1973), pp. 22-3, 54, 69-70.

free rein is large and the environmental problems are serious. One need only recap briefly in this respect:

(1) To provide space to meet the needs of all potential traffic in large cities would require astronomic sums which would run beyond the taxable capacities of the citizens; in turn it would also mean that other important services were sacrificed.

(2) To accommodate the car properly would absorb far too much space, displace too many families and require far too great a destruction of the life of cities. Los Angeles is a typical example of the harm that can be done.

(3) Provision for the private car tends to benefit the higher income groups of society most—they get most of the benefits and suffer the least costs. The reverse is true of the poorer sections of the community.

(4) To provide sufficient facilities for all vehicle traffic would be a misallocation of resources since mass transport facilities can do the job much better in terms of cost, since they benefit from increasing returns to scale.

(5) Unlimited use of private transport causes severe environmental and pollution problems. In many large cities the pollution from private cars has now reached a dangerous point. Car emissions cause the bulk of three major air pollutants—92 per cent of carbon monoxide, 46 per cent of nitrogen oxides and 63 per cent of hydrocarbons—and are responsible for small proportions of two others, sulphur dioxide and particulates (bits of solid matter including lead). The main one, carbon monoxide, is dangerous because it slows down the delivery of oxygen to the body tissues. High dosages can be lethal, while lower concentrations produce headaches and sluggishness. In many cities concentrations are above the safe levels.

A final solution may be the break-up of cities altogether and a policy of decentralization (though others would argue the opposite). But this is a very long-term solution and possibly a costly one and difficult to implement, though it may be the only one eventually to prevent the problem growing any worse. Eventually this will have to happen anyway because many cities will become intolerable to live and work in.

Here we have only looked at some of the more pressing transport problems which have been created by the revolution in transport during the twentieth century. They are not insoluble but drastic action, often politically unpopular, will have to be taken otherwise the end result will be far worse than the cure. At present governments are no better at handling the problem than the free market mechanism.