THE INFLUENCE OF PUBLIC TRANSPORT ON THE GROWTH OF EDINBURGH

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Many people assume that there is a close relationship between public transport routes and high densities of urban development. In Edinburgh at least this is not the case. Until the advent of the Green Belt policy in the 1940s sought to contain the radial extension of the City there was no great scarcity of building land which might have encouraged high densities. Moreover, the middle and upper income groups who formed the bulk of those moving into the suburbs, at least up to about 1920, were doing so in order to find the space which implies a low density of development. Fashion played a very large part in determining the exact location of the new housing, but public transport was a necessary condition for development to take place beyond a walking distance from the city centre. It was not however a sufficient condition. Because the City Corporation controlled both public housing and a large part of the public transport system, including an easily extensible network of motor 'bus routes, in the City after 1919, the suburban housing estates for lower income groups which they built could be located solely on the grounds of potential accessibility. These estates form most of the higher density suburban developments, and many lie in areas poorly served by public transport other than the 'buses laid on specially to serve them. The result of these many factors is that there is very little correlation between the patterns
of urban development in the City and the non-'bus public transport routes, existing and defunct.

The lack of correlation with the old railway network, now largely disused for intra-urban passenger services, is particularly disadvantageous because such a correlation would have allowed these disused routes to be reinigorated as rights of way for a new and competitive public transport system. Because of the way in which the City has developed, retaining a major concentration of employment in its central area whilst the housing areas serving this concentration have been devolved into suburbia, serious problems of congestion have arisen in and around the core, particularly at the peak work journey times. This congestion has been seriously aggravated by the increasing use of space consuming private cars in place of the public transport which first allowed the City to spread beyond a pedestrian radius. If past development were such that a new public transport system approaching the competitive ideal could be inserted into the existing city there would be a possibility of alleviating this congestion by attracting sufficient people away from their private cars to reduce the demand for road space to a level which could be accommodated adequately by the existing road system. In fact the possibilities for such a solution are limited, and, for economic and aesthetic reasons, so are the possibilities for large scale new road construction in the central area. Thus the answer to the congestion problem lies in a compromise between accommodation of the private car, development of public transport, and an adjustment of the
land use pattern. The actual solution adopted may therefore well be akin to that suggested as a preferred scheme by the City's planning and transport consultants in their 1971 interim report, 'Alternatives for Edinburgh'.

Similar considerations are likely to apply in other cities insofar as their growth is similar to that of Edinburgh, whilst, overall, the most important lesson to be learnt from the study is probably a reinforcement of the concept that, unless a city is consciously designed around its transport system, it will be likely to experience problems due to the malfunctioning of that system, as Edinburgh is now doing.
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Time present and time past
Are both perhaps present in time future
And time future contained in time past.
If all time is eternally present
All time is unredeemable.
What might have been is an abstraction
Remaining a perpetual possibility
Only in a world of speculation.
What might have been and what has been
Point to one end, which is always present.
Footfalls echo in the memory
Down the passage which we did not take
Towards the door we never opened
Into the rose-garden. My words echo
Thus, in your mind.

But to what purpose
Disturbing the dust on a bowl of rose-leaves
I do not know.

Other echoes
Inhabit the garden. Shall we follow?

T.S. Eliot, from
'Burnt Norton'
The idea for this study arose from a chance remark by Professor P. Johnson-Marshall to the effect that there is a discernable clustering of residential development around former tramway routes, citing as an example the Comely Bank area of Edinburgh (see map 16). That there were positive influences from public transport on the growth pattern of cities is a common assumption, but it suggested itself as a hypothesis which is by no means self-evident and which could benefit from being tested if it is to be used as a tenet of the planning process.

This being the case, it is the aim of this study to investigate the relationship which has existed in the past between public transport and the growth of cities, taking Edinburgh as a case study. Although, as will be seen, there was public transport performing local functions within the area that is now the City before 1830, there are reasons, which will be explained in the text, for beginning the main bulk of the study at about this date, although there has been a need to discuss the earlier history of the City briefly in order to set the scene. At the other end of the period factual information ends at the present day. Here the informed speculation of the planning process must begin.

In the case of Edinburgh the future role of public transport in the City is very much a live issue following the presentation in October 1971 of 'Alternatives for Edinburgh', a second interim report by the City's planning and transport
In this report they discuss the evaluation of four different possible solutions to what are seen by them as the problems which the City's transport system is likely to face in the twenty years to 1991. The present study examines this report, and the proposals put forward by opponents of its preferred scheme, in the light of what the historical study has revealed about the role which public transport has played in moulding the growth of the City. No attempt has been made to pass judgement on the various solutions because it was found that insufficient information on the demand curves for public and private transport was available to test the results which would arise from the use of the various measures. Research to obtain this information is beyond the scope of the present work, but an appendix discussing one part of the problem, namely the costing and pricing of car parking space, has been included. Finally, just as the study starts with a discussion of features of the world in general, so it concludes by discussing briefly the implications of its findings in respect of other cities, mainly those in Britain.

'Growth' is a word which can mean many different things when applied to settlements, as will be discussed in the main text of the study, but it seems sensible to give the key definition for the present work at the outset, so as to avoid misunderstanding. In this study, unless the context dictates otherwise, growth refers to the extension of the

1. Planning; Colin Buchanan and Partners.

Transport; Freeman, Fox, Wilbur Smith and Associates.
City's built-up area, and the concern is with the variations in the density, nature, and direction of this areal expansion. Even this definition embraces some small matters which have not in fact been studied, such as the barrier effect of railways on the direction of growth. The impact of public transport on the evolving form of the Central Area, on the expansion of the docks and of industry, and on the economic development of Edinburgh as a whole are outside the scope of this definition, and the reader should not therefore seek an answer to such problems in this work. On this basis, a fuller statement of the aim of the work may be given as follows:

'To investigate the relationship between the availability of public passenger transport between residential areas and areas of other activities and the direction, density and nature of the areal expansion of the City of Edinburgh from about 1830 to the present day, with a view to partially evaluating the current proposals for the transport system of that City over the twenty years 1971 to 1991, and to deriving general lessons about the part that transport must play in the planning of urban growth if there is not to be a problem of congestion.'

The boundary of the area for special study has been taken as the boundary of the City of Edinburgh as an administrative unit as it stands at the time of writing (shown on map 1), although it has been necessary to cast glimpses into the surrounding countryside both to set the scene geographically for the study, and to see the most
recent developments in the growth pattern. This definition is to a certain extent arbitrary, although it is convenient. No apology is made therefore for discussing Colinton before its inclusion within City limits in 1920 whilst largely ignoring the analogous situation of Currie today. To have drawn a wider boundary would almost certainly not have altered the conclusions of the study.

Because this study has concerned itself with a single aspect of the growth of Edinburgh, its studies cannot claim to be exhaustive. The space available works out at under 500 words per square mile, which is not much in which to discuss the history of a settlement, so that the impact of the influences on urban growth mentioned in section 1B is, with the exception of the influence of transport, only hinted at for the most part. A fuller description of the City's growth since 1850 may be found in Strachan's study of the rural-urban fringe, whilst matters such as the influence of developers and land-owners sitting on the boards of tramway companies are ignored and left for others to research.

The study is divided into four chapters, the scope of which is outlined in the introductory sections 1A, 2A and 3A, and a summary of the argument will be found in the Conclusion.

2. 'The rural-urban fringe of Edinburgh 1850 - 1967'
Chapter 1

GENERAL AND THEORETICAL ASPECTS OF URBAN PASSENGER TRANSPORT.

Section 1A

AIM OF CHAPTER.

This chapter is intended to set out the general and theoretical background against which the more detailed study which follows in subsequent chapters is to be understood. Sections 1B to 1E set out some general ideas on the growth of cities and on transport, and then in section 1F the existing ideas on the relationship between these factors are examined, with particular reference to the ideas contained in J. R. Kellett's book 'The Impact of Railways on Victorian Cities'. This book contains evidence which overturns the facile deterministic view that is sometimes expressed concerning the relationships with which it deals, and in the later chapters of this present study it will become clear that similar evidence may be discovered concerning the impact or otherwise of public transport on the growth of Edinburgh.

At the end of this study the implications of what is observed for Edinburgh are extended to cover the whole world: in this chapter the material gained from existing studies of the world is marshalled for the study of Edinburgh.

Cities have their origins in the places where people come together for such purposes as commerce, religious observance and administration, and this meeting place function is still the paramount one in the cities of today. Until the eighteenth century the size of British towns generally remained small, both in areal extent and in population total. Defensive and administrative needs long kept many towns confined within a wall, in the case of Edinburgh until the peace following the Jacobite rising of 1745. However, once peace was established, the more prosperous citizens of the towns saw that they need no longer live crowded together in the often insanitary and unpleasant houses within the old walls, and began the residential dispersal of the cities, leaving the commercial and administrative activities behind in the confined area of the urban core. Often, as in Edinburgh in the earliest years of the New Town⁴, the 'Idle Rich', who were present in the town only for residential and social reasons, were in the forefront of this dispersal, but it was not long before the habit spread to prosperous working citizens such as merchants and lawyers.

In time, residential dispersal affected people further and further down the income scale, but it was not until the advent of large-scale public authority housing in the 1920s

⁴ See section 2C below, also map 1 for location
that the manual workers from the city centres were constrained to join this exodus. Previously it seems that poor job security often made it advantageous for them to live near their work supply so as to be on hand to take whatever work might be going at the time it was to be had. This made some virtue of the fact that even had they wished to move out there was no suitable supply of cheap housing available, and in any case their incomes were so low that they could not afford the costs of daily travel over substantial distances to reach employment and provision markets in the urban core.

Working class housing up to the latter part of the nineteenth century was almost entirely provided by what the better off had cast off, and it was frequently in short supply relative to the demand, so that there typically developed an area of overcrowded slum housing on the fringes of the city centre. To some extent this is still true in 1972, but it has long been the declared aim of public policy, as embodied in the housing legislation, especially since 1919, that such slums should be cleared and their occupants rehoused in dwellings of a socially acceptable standard. Some of these replacement dwellings have been provided on the cleared sites, but, because the new standards do not allow as many houses to be put back as were removed, many more have had to be provided on new sites, normally on undeveloped land around the periphery of the cities. Cheapening public transport and the subsidisation of the housing programme to keep down rent levels allowed this move to the suburbs to succeed for many who made it, but there has remained a rump
of residential land use in the central areas, with both new and slum houses catering for those who still cannot afford to live away from their work. The result has been that generally the urban cores have developed as commercial, business and administrative areas surrounded by a ring of residential development, and the rather inflexible zoning theories which have held sway in the planning profession in the time it has been an effective instrument in directing development have tended to reinforce this distinction.

This concept of an annular development of cities is complicated by the presence of subsidiary activity centres within the residential ring. These include manufacturing districts, transport terminals, deliberately created local shopping centres, and the centres which result from the inclusion within the expanding 'master' town of older towns and villages close by. The manufacturing districts established in the nineteenth century were often at some distance from existing working class housing areas, and so they tended to be paralleled in their development by the construction of new, purpose-built housing for their workforce. For example, the Dalry area of Edinburgh appears to have become a residential area when housing was built around the newly established Caledonian Distillery. Good examples of the expansion of a town embracing other pre-existing places are provided by the incorporation of such places as Leith, Portobello and Corstorphine into the modern city of Edinburgh. Leith in particular has remained as an independently functioning unit within the greater whole.\textsuperscript{5}
Two other features common in the growth of cities remain to be mentioned. The first is the tendency for the residential areas to be divided socially in sectors, so that following a radial route out from the centre one may very often, but admittedly not always, pass increasingly recent housing, all of which serves similar economic groups. This affects public transport in that the loadings to be expected from an upper or middle income sector are likely to be different in size and incidence from loadings in a working class sector.

Finally, it may be observed that the latest trend in urban development is for the non-residential elements of the core to begin to decentralise from it, just as the residential uses have done in the past two centuries. This is due in part to the effect which this residential dispersal has had on the pattern of urban movements, as will be shown later in this section. At present the scale of this movement is small by comparison with the size of the core, and chiefly affects offices dealing with routine business, wholesaling, and the retailing of food and convenience goods.

Having in the previous paragraphs discussed broadly how cities have expanded, it is now appropriate to enumerate some of the factors which influence the nature, extent, and direction of this growth. These include:

1) The functions which the city performs, which determine its response to economic changes, besides being a determinant of the social and employment structure found.

5. See chapter 2 for details of these examples
2) The size and characteristics of the population, including the rates of population growth through time.

3) The topography of the site. Hills, steep slopes, rivers and valleys tend to channel development and to restrict its possibilities, whilst dry, open, geologically stable plains are attractive for development and allow it to conform to design ideals.

4) The pre-existing settlement pattern. As already mentioned, smaller towns and villages swallowed up in the expansion of a 'master' town tend to form suburban foci in the expanded settlement.

5) The location of industry within the area over which the town is expanding. There is a tendency for industry to deter the development of upper-income housing in its vicinity, whilst before the development of zoning theory in the second quarter of the twentieth century, and before the development of cheap transport for work journeys, it was a magnet for working class housing. As an urban feature factory industry is a phenomenon of the nineteenth and twentieth centuries, but in some cases earlier mill sites have been incorporated into growing cities to form the nuclei of modern industrial sites. Other areas have been created by new development on the outskirts of the growing cities, such as the Caledonian Distillery at Dailly, now incorporated into Edinburgh. Others again have resulted from the redevelopment of older parts of

6. See section 26 below, also map 14 for location.
the town. However it is rare in larger cities for industry to have intruded on the business core. The exact impact of industry will vary according to the nature of the establishments involved, some having more impact than others.

6) **Human ideas and ideals**, such as design standards and fashions. The amount of space each person is deemed to need for his various activities is incorporated in the design standards, and has been responsible for great changes in urban form, such as in the reduction of residential densities in many cities in recent decades. Correspondingly, fashion will help determine what densities are acceptable, and will also have a very large effect on the direction of growth since developers will tend to concentrate their efforts on the parts of town which are more fashionable addresses and can therefore command better prices and more certain sales.

7) **Land ownership and the related land availability**, which will often be potent influences on the direction of urban growth. A landowner who sees a chance to make money by developing his estates will make land available and, provided there is not too much land on the market, this land will be developed. On the other hand if an owner is not prepared to sell there has been until recently very little that could be done to bring about the development of his lands, so that expansion of the town in that direction is halted. Restrictions such as Entail attached to the estate may have a similar effect,
even where an owner is otherwise willing to allow development. However, the powers attaching to local housing authorities under the Housing Acts are theoretically sufficient to enable them to develop land for housing even in the face of an obdurate and powerful landowner. This has been the case from the earliest days of the legislation which gave local authorities even discretionary housing functions.

8) **Interaccessibility of the various urban elements.** This means transport, and it is the function of this study to investigate the effect of this factor on the growth of cities. People must be able to move between activities and a town is limited in its areal extent by their ability to do so. In many ways this is related to factors already mentioned, such as topography, which have an effect on routes available. In turn these routes have an effect on the growth of the city because the accessibility of a place on an existing main route to the rest of the city is likely to be significantly better than from a place off such a route.

Acceptable levels of interaccessibility vary from person to person, and a man with high job security may be more likely to accept a relatively inaccessible dwelling than one with low security. Further, higher incomes allow a man to spend more on transport, which will allow him to travel further or use a more expensive form of transport.
In section 2L the impact of transport innovations giving improved interaccessibility on the growth of Edinburgh is discussed. Liberating effects similar to those there described have been a general experience, and it should be noted that the use of private motor vehicles in modern cities to achieve improved interaccessibility often has an opposite result. Perhaps the most serious problem which the nature of growth of the typical city has bequeathed to the modern transport planner is that the concentration of business, commercial and administrative activities in the urban core, surrounded by a ring of residential areas, gives rise to so great a demand for movement between these two zones, particularly at the times when work is starting and finishing, that the inherited road network is often heavily congested. The solution of this problem may be achieved by enlarging the system to accommodate the increased demand, by manipulating the modal split within the system to accommodate the same total travel demand using less space, or by curtailing the demand. Chapter 3 returns to this problem with reference to Edinburgh.

Cities have grown considerably in the last two centuries, and this growth has been influenced by the factors outlined. The list given is not exhaustive, and the existence of other factors, listed or unlisted, must be born in mind in the consideration of the influence of one of them, namely public transport, on the growth of Edinburgh. In the next sections of this chapter the characteristics of this public transport and of its private competitor will be examined.
Section 1C
THE CHARACTERISTICS OF DIFFERENT TYPES OF URBAN PASSENGER TRANSPORT

1) The Private Car

It has been said\(^7\) that the characteristics of the ideal vehicle for private transport are that it should be

a) independent
b) ground based
c) manoeuvrable
d) capable of carrying at least two people.

The private motor car, in the petrol engined form which provides our chief genus of private transport vehicle today, displays all these characteristics besides others, and it seems likely that there will be a vehicle of this type in our cities for a long time to come, even if it does acquire a more acceptable propellent unit. From the point of view of the user it is probably the characteristic of independence which is the most important, giving the private car a very strong competitive position as regards convenience, as will be discussed in section 1D(2) below.

In modern society the private car has been elevated to a position more exalted than merely a convenient means of transport. Its days as a status symbol may be over now that its ownership has become a commonplace, but in

7. In a lecture given by Mr. MacKay of Jamieson, MacKay, the transport consultants from Glasgow.
'Ordinariness and Light' Alison and Peter Smithson argue as follows;

'Mobility has become the characteristic of our period. Social and Physical mobility, the feeling of a certain sort of freedom, is one of the things that keeps our society together, and the symbol of this freedom is the individually owned motor car.'

The practical outcome of this position of the motor car is that it becomes abnormal, and to a certain extent unrealistic, to consider the fixed costs of car ownership in comparing the user costs of different transport modes, although these fixed costs may be in the order of fifty pence a day for even the smallest relatively new car. This matter will be considered again in later sections of this study.

Whilst the car has reached this position it has not done so without making itself enemies on account of other of its characteristics. For example, the present vehicles have a very unfavourable road space need to load ratio as compared with 'buses, and their presence in large concentrations has seriously aggravated congestion in many city centres and other places. Again, they are in many respects a hazard to human health, both through the pollutant effects of their noise and exhaust emissions and through the accident potential which accompanies their misuse or mechanical failure. Yet this cannot detract from the very great advantages which the private car has brought when used in roles for which it is

suited and in which its external diseconomies are at a socially acceptable level.

Finally it must be noted that an important characteristic of the private car is that its costs do not vary significantly for the user if he increases the load within the vehicle's design limits, so that for family travel there are significant economies of scale to be realised.

2) The Omnibus and its variants.

Tracing a direct descent from the stage coach, the modern omnibus is a very versatile form of public transport which can perform a wide range of roles in an urban area. Each vehicle is relatively cheap to buy, and there is no requirement to invest in special track, although this may in some cases be desirable, as with terminal turning areas and lay-bys at picking up points, or with the purpose built Busway described below. In the past operating costs were somewhat higher than for trams or trolleybuses, but the labour element of this cost is now so large a part of the total that these cost differentials are too small to be significant when set against the advantages which the ordinary motor 'bus possesses. It is flexible in that it can go anywhere, almost, that there is a road, so that extensions and variations of routes may be undertaken with great ease. Because there are virtually no fixed costs to be spread over sufficient journeys to make them small enough to be economically acceptable, as there are for the fixed track forms of transport to be mentioned below, the 'bus is well
suited to the provision of infrequent or irregular services at acceptable cost.

In its conventional urban role the 'bus service is one in which the vehicles operate over a fixed route at fixed times, stopping at frequent intervals all along the route. The capacity of such a service is variable within wide limits to suit demand by the variation of service frequency and, to a lesser extent, of vehicle capacity. Typically, the basic network of routes is operated throughout the day at more or less regular intervals, augmented at peak times by extra vehicles and routes. To provide a faster service for the longer distance traveller express services having a more limited frequency of stopping places may be used. These may form a part of the basic network, like the 'Green Line' coaches in London, or may be operated at peak hours only, like the Edinburgh Corporation Transport's limited stop services. Another use of the 'bus supplementary to the basic services is the school or works 'bus, often operated on contract to school authorities or employers. These serve large traffic generators which give rise to significant passenger flows at certain times of the day only, and which lie off the basic network of services. The ability of the 'bus to provide this type of service, which cannot be done economically by the fixed track transport forms discussed below, allows a great flexibility in the choice of locations for such establishments. Finally it may be noted that 'buses and coaches can very conveniently provide the sort of 'one off' group transport which arises from club outings, large
weddings, and suchlike occasions.

One great disadvantage of the 'bus in its conventional setting is that it shares roadspace with private cars and commercial vehicles, and thus gets involved in the general congestion of parts of the road system, especially in city centres. To overcome this problem in situations where the congestion is regular and prolonged it is now often thought worthwhile to set aside special roadspace to allow 'buses to bypass the congested streets. The earliest attempts to do this by setting aside special lanes for 'buses in streets used by other traffic have not always been successful, but the more recent idea of building a separate track for the 'buses - a busway - giving them the characteristics of the reserved track forms of transport discussed below over a part of their route shows much promise. By this means the transport operator will be able to provide a system free from congestion problems in the city centre, but with the 'bus's advantage in serving the low density housing areas where the intensity of traffic generation cannot support a frequent enough service to spread the fixed costs of a fixed track transport system. However, unlike electrically powered fixed track transport systems, ventilation problems make it difficult and costly to put a busway, intended as it is for internal combustion engined vehicles, underground. Therefore busway routes must normally be threaded through the urban fabric on the surface wherever a suitable line can be found (which will often be along disused railway lines in existing towns).
3) Street Tramways.

In the study of street tramways in Edinburgh one meets three different types of locomotion - horses, cables and electricity - but in all these forms the tram was a slow form of public transport, whose routes were costly to vary, and which both suffered from and aggravated street congestion. Its advantages, realized best by the electric trams of the 1930s, were technical reliability and operating cheapness, and where a route carried a heavy and regular flow of traffic there can be no doubt that, in the conditions of its rise and of its heyday, the tram was the best available form of urban public transport. Because of its high fixed cost it was only economical to construct in areas where service frequency would be low, such as low density residential suburbs, if there was no alternative form of transport available. It was cumbersome to extend, requiring parliamentary powers which took two or three years to acquire, and in the modern city, where diversion of traffic is a commonplace, its inflexibility is a serious liability. However, if its technology is improved and its lines taken out of the streets, the tramway can become the basis of an acceptable form of modern urban passenger transport. Its more manoeuvrable and cheaper descendant, the trolleybus, did not possess enough advantages to make a great impact on the transport scene, and it does not appear in the Edinburgh story at all.
4) Rail transport.

Railways are the oldest existing form of fixed track transport, and have in Britain nearly always run on a reserved alignment free from all congestion not of their own making. In its conventional form the railway carries a variety of different types of traffic along its tracks, and, before the advent of a reliable motor lorry during World War I, freight traffic played a significant part in the working of intra-urban branch lines. Where there is a large source of traffic in a particular place, as with a large factory or docks, this role may be retained, but the intra-urban passenger railway of today has in general to rely solely on its own earnings. Conventional railway equipment is heavy, and it is difficult to achieve a power to weight ratio high enough to allow accelerations which allow satisfactory operations with station spacings of less than about a mile. This is a serious disadvantage for urban operations, but even this spacing causes problems of interference with other, faster services where the two have to share tracks, so that intra-urban and suburban services tend to be operated only on secondary lines or in situations where there are separate tracks for fast and stopping trains. In Britain today suburban railways are found only in the largest conurbations, and in one or two cases around medium sized cities, but even these surviving services are often in jeopardy having lost large numbers of passengers to other forms of transport. It seems that the conventional railway is unsuited to modern urban transport needs. Whether it was ever suited to this
role is a question to which this study will return, and on which 'The impact of Railways on Victorian Cities' also throws useful light.

However, the fact that a railway train is capable of moving people in units of over a thousand at a time means that it has some value in the urban situation where the flows offering are large enough. The form in which it is now appearing in cities of 800,000 or more people to fulfill this role is a modification of the conventional in the direction of the tramway. Lighter vehicle weight allows an increase in the power to weight ratio, resulting in acceleration characteristics which enable stops to be brought within about half a mile of each other. This means that a given length of line can have stops within a quarter of a mile of more people than can the conventional railway. As with all fixed track forms of transport the capital cost of the light urban passenger railway, usually electrically powered, is high, but, if it is completely segregated from the conventional railway system, it is capable of moving very large numbers of people. Judging by London experience, a single line of track is probably capable of taking a train every two minutes. Assuming that the trains are shorter than the British Rail London suburban ones which can carry something in the order of 1,200 people each (and such an

1. This distance of about a quarter of a mile has significance as a threshold, see below p. 38
assumption seems sensible from what is happening on emergent systems elsewhere in the world) each train could carry perhaps 600 people when well loaded, so that a single line of rails would be capable of delivering 18,000 passengers every hour. However where such feats are not required and only a small number of passengers are likely to be carried the capital cost cannot be spread sufficiently to bring it down to an acceptable level. It is for this reason that the consensus of opinion seems to be that such systems are currently unsuited to towns smaller than about 800,000 people unless there are special circumstances.2

5) Other forms of urban passenger transport

The taxi is a form of transport which has many characteristics similar to the private car, and it is a useful form of public transport for journeys by small groups of people, especially those with cumbersome luggage which would be unwelcome on other forms of transport. It tends to make far more trips each day than the private car, and is thus economic in its use of parking space. On the other hand the user pays the full cost of the journey, rather than perceiving a cost which is only the cost of petrol, and this cost includes the cost of the driver, so that the taxi is a very expensive form of transport. There are suggestions for adapting the taxi type of service to small 'buses. This 'dial-a-'bus''

2. This subsection has been partly based on information in recent issues of the British periodical 'Modern Railways'.
type of system is proposed for the New Town of Milton Keynes, and also looks a promising way of providing a basic service in residential areas such as Ravelston Dykes in Edinburgh where the traffic generated is too small to adequately justify a conventional 'bus service of acceptable basic frequency.

Other transport innovations likely to affect the period covered by chapter 3 of this study are in general variations on the basic fixed track transport system already outlined, and although they may employ a different technology it is unlikely that their service characteristics will be much different, although they may allow slightly closer station spacing. An exception to this generalisation is the possible introduction of a moving walkway type of technology which will be able to provide a continuous service on routes where there is a concentration of traffic. The elimination of waiting time, which is a disadvantageous characteristic of other forms of public transport, will be a great attraction of the travolator for such purposes as linking peripheral car-parks to the city centre, but a very high traffic volume will probably be necessary before the installation is economic.
THE DETERMINATION OF THE MODAL SPLIT BETWEEN PUBLIC AND PRIVATE TRANSPORT.

1) The appreciation of available means.

When considering what means of transport to use for a particular trip the potential traveller has broadly four choices open to him. He may choose not to make the trip, or he may choose to walk, in either of which cases the trip will not enter the transport system and will therefore be of concern in the present discussion. The remaining choices are public transport or private transport, and it is with the choice which the potential traveller will make between these two modes that the present section is concerned.

For many people only one of these choices, namely public transport, is available, and it must be remembered in reading the following chapters that only since the widespread application of Henry Ford's innovation of the mass production of motor cars made private transport increasingly available has this group of people not been the vast majority of the population. Moreover, it seems that there will never be an identity between potential travellers and private vehicles. The young, the old, the poor, the disqualified, and those who merely choose not to spend money on a private car will always exist, and this group of people will continue to provide a base load for public transport since they have no alternative. However, there is the possibility that if the public transport system does not cater adequately for those
who could, but in fact choose not to, own a car they will eventually become car owners. Therefore this group cannot entirely be forgotten by the transport planner seeking to shift the modal split balance in favour of the public sector.

The question of a person's appreciation of the means of transport available to him becomes more important when considering people who have a private vehicle at their disposal. Prolonged use of the car may lead to a lessening of awareness of the alternatives, and there may well be a hard core of habitual drivers who cannot perceive using any means other than their private motor vehicle for intra-urban journeys. The remainder of the group who have a private car available will be susceptible in varying degrees to active canvassing of the public transport alternative, and it therefore seems important that the public transport operator who wants to win extra traffic should keep his product well before the public consciousness.

2) Factors influencing the choice between modes.

'Motivational research seems to show that the key marketing factors affecting use of public transport for short urban journeys are frequency, speed and reliability with cost and comfort following.'

This remark is a good summary of the background factors influencing the choice between transport modes, determinant of the modal split, but it does not include the factor of

convenience, which undoubtedly has an influence, although not one which can be exploited by the passenger transport marketer because on balance it is not a factor which counts in favour of public transport. In the remainder of this section these factors will be examined one by one from the point of view of a public transport operator.

a) Frequency and speed

Together these two factors determine the overall journey time. The public transport operator must expect to compete with the car in the urban situation on the assumption that his customer will start his journey without any thought for the timetable, and hence will arrive at the boarding point having just missed a service. Therefore it will be wise to assume that the overall journey time which the passenger will consider in making his choice is this one of having a maximum wait, although the lengthening of journey time in his perception through inactivity will probably be offset by his hope that he will arrive with not too long to wait. Because for short urban journeys the overall journey time is small, it becomes necessary for the frequency of the service to be high so that the expected waiting period will not be out of all proportion to the journey time.

The speed of public transport varies greatly between modes, a 'bus running on a congested road being capable of a much lower maximum speed than a purpose built rapid transit train on its own reserved track. Actual overall average running speed on a particular trip will be determined by
vehicle capabilities as regards speed and acceleration, congestion delay, the delay caused through setting down and picking up passengers, and the requirements of the timetable, although the last of these may be, and indeed probably should be, determined by a realistic appraisal of the other three. Under present conditions it is possible to design a vehicle for any type of public or private transport commonly in use to a given specification as regards acceleration and maximum speed. Thus, because private cars do not generally have to stop to set down and take up passengers, public transport can only offer a competitive journey time if it is subjected to less congestion delay and allowed a faster running speed than private transport. This means providing reserved tracks or 'bus only lanes to bypass the congestion. Also the delays due to passengers getting on and off should be reduced to a minimum, but this at present conflicts with the manpower economies to be gained by one man operation of 'buses.

If public transport times are to be competitive with those by private vehicles the speed attained must be sufficient to offset not only the expected waiting periods at the boarding point but also the walking time between the actual origin and destination of the journey and the points that the public transport serves. In city centres this is frequently equal to or less than the time taken to get to or from a parking space, but most journeys have at least one of their ends in the suburbs where the private transport can usually be brought right to the trip end. Not only does
this affect the relative convenience of the various modes (see below) but it also tends to lead to a longer overall journey time by public transport than by private car, even if public transport can, through the avoidance of congestion delay, offer a faster journey. Because time is only one factor taken into account in modal choice, competetiveness does not necessarily require an absolutely shorter time, but rather a time that is not so extended by comparison with that attainable using private transport that it outweighs any other competetive advantage that the public transport system might have.

b) Reliability.

Public transport in Britain today, and probably in other parts of the world as well, has a bad reputation for reliability. This stems from two basic causes; congestion delay in excess of that allowed for in the schedules, and staffing problems. For the operator the first of these has the easier remedy, using more realistic schedules and providing means for public transport to avoid the congestion. However the problems of staff supply are less tractable, although the severity of the problem differs markedly from place to place. Public transport is not an industry which can employ its workers on the conventional regular hours,

4. The more realistic schedule will probably gain more from increased reliability than it will lose in competetiveness from a longer advertised journey time.
and it is characterised by shift type working, including split shifts to cope with the twice daily peak hour traffics. Moreover, there are strict limits to the maximum number of hours a driver can work, so that an operator has little chance of covering any shortfall in his staff by overtime working. The unattractive shifts are a deterrent to potential employees, and even if the average earnings are good it may not be possible for the operator to pay sufficient to attract an adequate supply of suitable labour in areas with high levels of employment. Thus unreliability on account of labour shortage is likely to be highest in areas which are also potentially areas with high levels of car ownership, so that there will be a swing away from public transport in such areas leading to a further increase in unreliability on account of the increased congestion delay that private car usage at an increasing level will lead to. Therefore it is desirable in a system of public transport that it should be as immune as possible to unreliability due to labour shortage. The more certain a private car owner is that public transport will run when it should, the less likely he is to use his car for a journey for which public transport would otherwise be his choice. Motor cars are known to be available, and in most cases their owners assume that they will not suffer a breakdown on their journey, so that public transport has a very high level of perceived reliability to compete against.
c) **Cost.**

It was shown on page 15 above that the perceived cost of private transport journeys is lower than the real cost because motorists generally do not take fixed costs such as insurance into account, but only such direct costs as petrol and parking fees. Moreover, there are substantial economies of scale to be realised if extra passengers within the car's capacity are carried, as on a family outing. This second consideration is important to the public transport operator because small group trips are most commonly made in off-peak hours, especially in the evenings and at weekends, which are the times when the operator has his biggest problems in attracting sufficient custom to meet his minimum economic load factor.

The public transport operator's costs arise from many sources, and he cannot ignore his fixed costs. At present the cost per passenger-mile appears to be about twice the perceived cost per private car -mile (exclusive of parking charges) for intra-urban journeys, and the differential may be even greater than this. However, price appears to be of only secondary importance in public transport marketing, provided that it is not set at a prohibitive level. Moreover, there exist legal mechanisms whereby the effect of uncompetitive price levels can be offset by local authority or government subsidies to allow fares to be set at a competitive level below cost. Because of the apparently low price elasticity of demand for intra-urban public transport, it seems that in most cases the increased carryings resultant upon a price decrease will not produce sufficient extra revenue to cover
the loss of earnings from existing passengers, let alone produce an increase in the total revenue. Hence cheaper fares will almost inevitably imply a subsidy. From the viewpoint of the transport planner it will make economic sense to provide these subsidies, either to cover the capital costs of improvements to the service or a proportion of the running costs, if such spending is expected to attract sufficient extra passengers to public transport to eliminate the need for an alternative investment in facilities for private cars which would cost more, either absolutely or in cost-benefit terms. The present scale of public subsidy for the largely publicly owned public transport system in Britain is quite small, and it is common to find transport undertakings being required to charge uncompetetive fares in order to balance their books. This position may change if there is a move towards planning and financing urban transport as a whole, rather than by its separate components as is common at present.

d) Convenience.

The most difficult advantage of the private car for the public transport operator to offer competition to is the fact of its convenience for many types of journey. The private car is normally available to its possessor at all times, and will take him from his own front door to virtually any destination he may choose without there arising any need for him to change his vehicle. If there are heavy parcels to be carried this can be done very easily by the car user,
much more conveniently both to himself and to the fellow travellers he might have had he chosen to use public transport. The first advantage is realised most readily where the trip ends are not in a congested area, and is particularly important in the case of inter-suburban social and recreational trips. Because of this there have been substantial reductions in the demand for public transport in the evenings and on Sundays, at least in areas where there are high levels of car ownership. There is little the transport operator can do to win back these trips because either the trip would never have been made if private transport was not available or the convenience of the car is of so great a significance in the modal choice that nothing public transport can offer will be sufficient incentive for the change to be made. The second advantage of convenience which attaches to the car in its capacity to carry heavy parcels very easily has most effect in its influence on shopping trips for food and convenience goods, trips which were probably not made by public transport in any case because these goods are traditionally purchased locally.

Whilst the private car offers the potential convenience of door to door transport, problems arise in disposing of the vehicle at the destination until it is wanted again. In residential areas this is not usually too difficult, but in business and commercial areas, and in particular in city centres, where there is a concentration of trip ends, problems arise which diminish the convenience of the car. In such places a parking space to leave the car is frequently
difficult to find, and may be located at a considerable distance from the actual desired destination. Further disadvantage arises because the provision of these parking spaces is a cost to the community as a whole which is being increasingly passed on to the individual user. Moreover, it may be the case that it is impossible to find enough land for parking at a price in economic and environmental terms which the community is prepared to pay, so that the convenience of the car may be diminished further by a restriction on the numbers in which it is allowed into congested areas.  

The motorist who has to park at a distance from his actual trip end is placed in an analogous position to the user of public transport who will generally suffer the inconvenience of getting to and from his conveyance at both trip ends. The inconvenience of public transport in the eyes of the user will also be increased if he has to change vehicles. In some cases it may be possible thereby to provide a quicker journey overall, but the gain in time must be sufficient to offset the inconvenience the change causes. Similarly, where it is hoped to provide a system such as park-and-ride which enables the motorist to capitalise the advantage of his car where it is possible to do so, but which persuades him to leave his car outside a congested zone to the benefit of the community at large, the inconvenience

5. See also section 38 and appendix A
6. See also pp. 27 and 28 above
of modal change must be overcome by advantages such as reductions in journey time or cost, or the elimination of other inconveniences which would arise if the private car were taken to the ultimate destination. Because of this, the use of mixed modal journeys as an important part of a transport system in a city of comparatively small compass (say less than five miles radius) needs to be undertaken with care and circumspection if it is undertaken at all. However, where it has been necessary to restrict the amount of parking available in a large city centre and to introduce peripheral parking for a significant proportion of the demand, a good public transport link between the car parks and the city centre will help to make the restrictions on access to more central terminals more acceptable. In such cases, however, it may be advantageous from the transport operator's point of view to attract the customers for the whole of their journey, and this would, if successful, also be of benefit to the whole community in that there would be a reduced need to provide land for these peripheral parks. The resolution of this matter is, however, a question for the transport planners to decide in the light of their policies for the urban transport system as a whole.

e) Comfort.

Comfort is not at present a notable attribute of urban public transport, and if the competitive position of these modes is to be improved against the yardstick of the private car much work will have to be done to improve matters, and
when a satisfactory solution is reached it will have to be broadcast to the potential customers by persuasive advertising. In all probability mass public transport can never achieve as high a standard of comfort as the individual private car with its deep upholstery and adjustable seats, but the present standards in many 'buses and trains seem to be capable of great improvement with research. However, public transport does have a competitive advantage in the related aspect of fatigue, for the private car driver, especially in cities, is subject to considerable stress which can be avoided by using public transport. This is an advantage which public transport advertising has already begun to emphasise.
Section 1E

IDEAL PUBLIC TRANSPORT

There are several ways of approaching the question of what constitutes ideal public transport, depending on the answer to the question 'Ideal for what?'. In the case of the present discussion it is in the context of the solution of the problems of urban congestion, so that the ideal public transport will be ideal for carrying the maximum number of passengers, thereby reducing the number of private vehicles in use and so reducing congestion, insofar as it is caused by the presence of such private vehicles in large numbers. Therefore the ideal form of public transport in this context will be that which matches the various characteristics as described in section 1C with the factors determining modal choice outlined in section 1D to give it a maximum competitive advantage.

In general there is little that can be done to alter the relative levels of convenience of public and private transport, although for trips to city centres parking policy can be used to switch the competitive advantage in favour of the public transport system. This competitive advantage is also affected by the ease with which the public transport system can accommodate passengers' luggage. For example, easily approached boarding points, wide entrance doors and plenty of standing space would increase the attractiveness of public transport for a mother with a baby in a perambulator, and the ideal public transport system will be so designed.
The design will also have regard to considerations of physical attractiveness. Clean, weatherproof vehicles with sufficient seating to allow people making a journey of more than two or three minutes duration to rest will be characteristic of the ideal system. Moreover, in the current climate of aesthetic opinion, the ideal system will be compatible with the existing environment.

The physical attractiveness of the system must be matched by reliability, and, insofar as this concerns technological matters, many existing systems have proved themselves capable of offering very high standards in this regard. On the other hand, reliability also concerns the human element in operation, and this presents problems that can never be fully overcome. Strikes will always present a threat to reliability, although good labour relations will minimise the risk so that it no longer matters with regard to the modal split competition. However, the ideal public transport system will need to be shielded as far as possible from the possibility of serious unreliability arising from labour shortage. Thus it will probably employ large vehicles or trains, coupled with a high degree of technically reliable automation, to reduce the total labour requirement to what the local labour market can be expected to provide.

Another factor in the modal split competition, and almost certainly one of the most important, is journey time, although

7. This suggests that travolators, which lack seats, are unacceptable for all except very short journeys.
it seems likely from personal experience that differences of less than about five minutes are not significant. In the previous section it was shown that to obtain competitive journey times public transport must bypass congestion using some form of reserved track. This also allows higher running speeds than are legally possible on most urban roads, so that the ideal form of public transport will obtain a maximum competitive advantage on journey time by using a reserved track throughout or, in cases where it is being fitted into a non-ideal urban form, for as much of the route as possible.

Shorter journey times may also be obtained by reducing the number of stopping places along the route of the public transport, but this must be balanced by the need for a competitive ideal transport system to be brought within about five minutes walk of every potential customer if it is to attract that customer away from his private transport. The actual optimum will depend on the characteristics of the vehicles in use, but in any case a spacing of about twice the threshold walking distance, equivalent to about half a mile between stops, seems to be about the maximum desirable in continuously built-up areas where no feeder transport is in use.

To further minimise expected journey times, and to

8. This threshold distance of about a quarter of a mile seems to be the maximum beyond which people with private cars available are reluctant to walk to reach public transport.
overcome the deterrent effects of waiting times which might exceed a threshold of acceptability of about five minutes duration, the ideal public transport system will provide a frequent service. Over short routes with intensive use travolator links offer a potential for completely eliminating waiting time, but, as has already been mentioned, other factors count against their use on other routes.

The picture then emerges of an ideal system of public transport being in general one which operates a frequent service over reserved tracks, with each unit of the service carrying a large load, or at least having a capability of doing so. Such a system will be costly to build and operate, so that the maximisation of passenger carryings becomes not only the respect in which the system is ideal, but also an essential requirement of its operating economics in order that costs per passenger-journey are kept to a realistic level, whether or not the whole cost is passed on to the passenger through his fare. This means that the service must operate within areas which generate large traffic flows. In city centres this is relatively easy, but in housing areas it is more difficult because the potential customers tend to be diffused over a very wide area. Because there seems to be a threshold distance beyond which people with private transport are reluctant to walk to reach public transport, the ideal system will come within this distance of the larger part of the population to be served so as to be generally attractive. This will be most satisfactorily achieved if the housing areas of the city are concentrated along radii
focussed on the city centre into which transport lines can be introduced. These radii cannot be over-extended or else the spaces between them and nearer to the city centre will become so much more attractive than the farthest points on the radii that it will be impossible to resist the pressure for the undesirable intensification of development in these areas away from the public transport potential. This means that each radial line will serve a relatively small number of suburban stops, so that, if sufficient traffic is to be generated to justify the level of service required for competetiveness, a large number of people will have to live clustered around each stop. In other words, the ideal urban form into which to introduce the ideal public transport system is one which has its population concentrated in high density radial developments.

However, the housing areas of many cities today do not show such radial concentrations of development, and this will be seen to be the case with Edinburgh when it is examined in more detail in the next chapter. To bring the transport service to within the threshold distance of a majority of the population in such circumstances implies a considerable bifurcation of routes at the suburban end, and such branches would serve too few people to justify the cost of their construction if they were built in the reserved track form. There are two possible answers to this problem. The first is to bypass the congested areas with busways and then allow the 'buses to operate over the uncongested suburban roads to provide the bifurcating routes. The
disadvantages of this solution as opposed to the ideal situation are that if there are a large number of routes branching from one busway the justifiable frequencies in the suburbs may be comparatively uncompetitive, and that it is probable that such a system would use smaller service units resulting in a greater input of labour per passenger. This has been shown above to be potentially detrimental to reliability. On the other hand, the advantage of being able to ride in one vehicle all the way from suburb to city centre is retained, which it is not in the alternative solution. This would be to use a fixed track form of reserved track transport as in the ideal situation, with stations at important suburban nodes from which the housing areas would be served by feeder 'buses. The problem with such a mixed modal system is that people find it inconvenient to change vehicles, and in a system where the average trip length is in the order of three miles⁹, and the maximum radial distance from the city centre is about six miles, as is the case in Edinburgh, it seems probable that any advantage accruing from the change would be insufficient to offset the inconvenience of the change itself.

So far the discussion has related principally to the heavy flows of traffic between suburb and city centre which are responsible for the problem of central area congestion. It is now pertinent to turn to the question of the accommodation of inter-suburban flows in the ideal public transport

situation. One may first note that radial flows will be accomodated by the transport system serving trips to and from the city centre, and this will probably also apply to diametric trips across the city centre, but some other sort of provision is necessary for other trips. The types of journey involved are likely to be somewhat different from those to and from the centre, and even where there is a substantial concentration of trip ends, as on a large school or industrial site, that concentration's trip generation will generally be of a much smaller magnitude than the city centre's. With the exception of suburban shopping and commercial centres there will not be the high level of business trips outside the peak hour which is a feature of city centre areas. Many of the inter-suburban trips are family and social trips made between houses, which are not great trip generators, and such trips can often also realise the economies of scale which are a characteristic of the motor car. Another common type of trip will be the weekly food shopping trip to the local supermarket, and, although such places are moderate trip generators, the advantage of the car's convenience as a carrier of heavy goods will again make the competitive position of public transport difficult. It seems that the inter-suburban trips present a pattern which does not often include large concentrations along a given desire line, but rather one which is characterised by a complex pattern of desire lines, each matched by a very small flow. The trips are made in circumstances which are less favourable to competition by public transport than
those for trips to the city centre, both for the reasons already given and because there is normally a minimal problem of congestion delay to be overcome. In such a situation there seems no case for the provision of reserved track forms of public transport, which are expensive, and it also seems that there is no real need to do anything more than provide for those trips which people who do not have access to private transport want to make. The various types of 'bus service described on pages 16 to 18 above will do the job admirably, and also provide feeder services from low density residential areas between the major radii if this is required. Even if it were decided to provide more than such a basic circumferential or tangential service it is questionable whether the situation would be such that the 'buses would attract more than a very few car passengers, given their inconvenience relative to the car.

One final feature of the ideal public transport service remains to be mentioned, but it is the important one that information about the system must be well disseminated. Many of the misconceptions about public transport current today amongst those who are not its devotees and regular users are harmful to its competitive image, and could be avoided if correct information were more readily available.

Although this section has been concerned with an ideal system of public transport, it should be remarked that where an urban transport system cannot incorporate this ideal, the method of competition which public transport should employ remains in essence the same, and the actual system used
should exhibit as many features of the ideal as possible. However, given that the aim of an ideal system is to reduce congestion, the ideal public transport situation appears to be represented by a rail rapid transit system running through areas of high residential density, so that its customers are concentrated around its stations. If, as will be shown to be the case in Edinburgh, the ideal density situation does not exist, the best compromise may be to combine the flexibility of the 'bus with the congestion avoiding capabilities of the reserved track in the form of the busway.
EXISTING IDEAS CONCERNING THE RELATIONSHIP BETWEEN PUBLIC TRANSPORT AND THE GROWTH OF CITIES

The traditional view of the relationship between public transport and the growth of cities has been well expressed by Lewis Mumford as follows;

'Now, though the growth of great cities began before the railroad was invented, it was the railroad in all its forms - the steam railroad, the underground and the electric tramway - that concentrated the population along railway lines and around their great terminal metropolises.'

In contrast, in 'the Impact of Railways on Victorian Cities' Kellett asks,

'Was the railway's role in stimulating suburban extension as important as is usually assumed; and how, precisely, did the provision of services by profit making companies link up with the promotion of suburban building?'

He answers these questions in chapters XI and XII of his book, where he shows that, whilst it is generally assumed that there is a causal relationship between public transport and intense land use, with the former giving rise to the

latter, in the five British cities which were his case studies this was by no means always the case. Although the availability of public transport was a necessary condition for development in the days before the widespread availability of private cars, it was neither a sufficient condition for this development to take place nor did it lead to the intense land use which it is popularly thought to have done. Much depended on the individual railway companies and developers, but in general railway suburbs were not developed, in the nineteenth century at least, at high densities with a view to maximising the number of people benefitting from the proximity of the railway facility. Rather they were designed to accommodate the more prosperous citizens, and were consequently laid out on a spacious plan. Complex relationships exist between railway fares, facilities, customers and receipts, and it seems that it was more profitable to carry a small number of passengers at top rates than to encourage mass travel at cheap fares. For the outer suburban developer too, in a city the size of Edinburgh, there was profit in exclusiveness. The demand for his products was not large at least in relation to the land available, and since the potential customers were generally seeking an escape from the confines of urban life, the relatively tightly packed houses put up by the developer of the inner suburbs would not have sold well had they been built in these more remote areas. However, if the developer concentrated on large houses with good sized grounds of the type sought by people who could afford to live so far from their work, and if he
promoted the fashionability of his neighbourhood, he could probably make a very reasonable profit.\textsuperscript{3}

It must be remembered that, in the days when the railway suburbs and the similar tramway suburbs were built, private transport was rare, and even the rich were accustomed to walk to a far greater extent than are people today. Hence, even if a man could not afford the cost of keeping a carriage in addition to his domestic and travelling expenses, he would still be quite happy to live at a considerable distance from the railway station or tramway. Thus, with demand restricted by the lack of cheap fares and the price of suburban housing, it could comfortably be met by low density development. From the conclusions of the precious section it will be seen that such low densities near old railway lines, which would provide opportunities for the installation of modern fixed track public transport after the ideal model, are a serious problem for the modern transport planner. They have tended to push the later, twentieth century high density suburban developments into the areas between the old suburban railway routes where it is now difficult to find a satisfactory line along which to insert a reserved track form of public transport.

Thus Kellett's work casts serious doubts on the truth of the popular concept as expressed in the above quotation from Mumford. There is a need to determine what was cause

3. Fashion pushes up the demand for houses in favoured areas, and hence they command a higher price than otherwise.
and what effect in the relationship between public transport and the growth of cities, and one must also distinguish clearly between necessary and sufficient conditions for that growth. Perhaps the direct causal relationship which the present study sets out to show is far from true is less widely held than the author believes, but in any case it will now be appropriate to consider the case study of Edinburgh.
Chapter 2

THE RELATIONSHIP BETWEEN PUBLIC TRANSPORT AND THE GROWTH OF EDINBURGH FROM 1830 TO THE PRESENT DAY

Section 2A

INTRODUCTION TO THE CHAPTER

At the close of the last chapter it was indicated that although some work has been done on the effect of public transport on the growth of cities, there still seems to be a school of thought which implies that this relationship is significantly deterministic. The aim of this chapter is to consider the relationship which existed between the public transport provision in Edinburgh and the characteristics of its growth in terms of streets and houses. In doing so it must necessarily consider the other factors which have influenced this growth⁴, so as to see what the significance of public transport was relative to these, and to aid a fuller understanding of why and how the town grew. The geographical features of the town which have a bearing on these other factors are discussed in section 2B, and the historical development of the City down to 1830 is described in section 2C. Section 2D discusses why Edinburgh grew at all after 1830, drawing a distinction between population changes, boundary changes, and building extension as aspects of growth, and section 2E outlines in general terms the development of the public transport system in the City during

⁴. As outlined in section 1B, pages 9 to 12 above.
the study period. The discussion of the relationship between public transport and building activity then follows, covering several sections but divided into two parts by a resumé of the situation in 1920. This division reflects the differences in growth as between the years before the first World War and the years after it.

The principal source of information on the transport system has been 'Edinburgh's Transport' by D. L. G. Hunter, whilst the areal extension of the City has been dated by analysis of various editions of the 'Edinburgh and Leith Post Office Directory' which, despite its limitations, appears adequate for the present work. Information on house types and other features presently observable has been collected largely by field observation.

5. Published by the Advertiser Press, Huddersfield, Yorks. 1964.

6. For details of this annual publication, its limitations as a source, and the years used, see appendix B.
SIGNIFICANT GEOGRAPHICAL FEATURES OF EDINBURGH

The City of Edinburgh has grown around two principal features; the defensive site of the Castle Rock, and the natural haven of the mouth of the water of Leith. The former gave the town security, and was far enough back from the coast to be out of the range of pirates: the latter, now developed by human artifice into a substantial harbour, gave the citizens of the town the means to trade and travel, and so to develop commerce. Since the conjunction of these two features has proved to be one of the best of its kind around the shores of the Firth of Forth, it is no wonder that the city grew up where it did, although there are other features which have contributed to that growth.

The land around the Castle Rock over which the early expansion of the City had to take place is hilly, and the slopes around the old core of the town below the Castle are so steep that it was found desirable in the expansionist period of the late eighteenth century to connect this Old Town ridge to its neighbours by the construction of some quite large bridges. To the north the land falls to a coastal plain something over a mile wide along the shores of the Forth, but the development of this plain has been related more to the port settlement of Leith and to the resort settlement of Portobello than to the core settlement of Edinburgh proper, as will be seen in sections 2H and 2I below. The coast itself limits the possibilities for
development on the north and north-east of the City. On the south the City has had to develop over an undulating terrain, rising gradually towards the foot of the Pentland Hills. It is of significance that the 'grain' of the country in this area runs tangentially to the radial routes from the city centre. On the east of the Old Town the most significant feature is the Royal Park of Holyrood, incorporating the craggy mass of Arthurs Seat, which has not been available for development, and is in any case unsuited to it for the most part. Westwards the fairly flat lands, beds of former glacial lakes, which lie between Murrayfield, Corstorphine and Sighthill have been as attractive to development as the steep slopes of Corstorphine Hill have been inimical. It is worth noting, however, that although the land westward of this hill is often steeply graded, as at the Drum Brae, this has not prevented its development in the face of a land shortage in the 1960s. In the southern part of the City too there are isolated craggy hills, such as Blackford Hill, which have, through their steepness, had an effect on the development of the City, and in channeling routeways. In addition to these hills and plains, the deep incision of several of the rivers and burns has influenced the City's growth. This is particularly important in the section of the Water of Leith between Roseburn and Stockbridge where the gorge runs transverse to the radial lines of communication from the city centre, and has therefore required special measures, notably the Dean Bridge, to provide satisfactory access to the lands west of it. In its other
gorge section, upstream of Slateford, it runs radially, so its effects on the transport system have been of a different nature, and it was indeed exploited by the railway built to serve the places along its banks.7

Although Edinburgh lies in the region of the meeting of the routes from the south by way of the Esk Valley with the east to west route along the coastal plain, near to the lowest crossing points of the Firth of Forth, the most significant direction of movement into and out of the City today is from the west, both from Fife and the north over the Forth Bridges at Queensferry, and from the remainder of the major concentration of the Scottish population in the Central Lowlands, including the Glasgow conurbation. In the past its position helped to make the City the Capital of Scotland, but in modern conditions Edinburgh's position is peripheral to the main concentration of Scottish economic activity, and this may be having an effect on the present development of the City.

The functions of Edinburgh are varied, but, despite being almost surrounded by the Lothians coalfield8, industry is relatively poorly represented in the workforce, accounting

7. In this chapter maps have been provide to locate places and features mentioned in the text. For the preceding paragraphs see map 2, and for the remainder of this section see maps 3 and 4.

8. There were once mines even within the City's boundary on its southern and eastern fringes.

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for 24% of those employed in the City, as against 33% in Glasgow\textsuperscript{9}. There is a large concentration of jobs in the types of employment which concentrate in the city centre, which is important in evaluating the traffic problem which the City experiences. This has been typical of the City throughout the last two centuries, and the relative unimportance of the nineteenth century 'growth industries', such as iron working and textiles, helps to account for the lack of expansion in the 1830s which will be discussed later in this chapter. At the present time the growth of the tourist industry is of particular importance to the City, and is a major reason for the importance given to the preservation of amenity when solutions to the present transport problems are discussed, as in chapter 3 below. If a transport solution is adopted which involves the destruction of important parts of the amenity and character of the central area of the City, then the local economy may suffer.

Finally, it should be noted that the City is a net importer of labour, as figure 1 indicates. This is largely because of the recent development of overspill housing as described in sections 2K and 2L below, and, as the figure shows, one of the largest flows is from Currie District, which would not figure in the labour import if the boundary of the continuously built-up area were taken, rather than the City boundary. Apart from Musselburgh, the other trips have fairly diffuse origins, and so it will probably not

9. Source as for table 1, q. v.
make too much difference to the conclusions of later chapters if all these trips across the city boundary are ignored.
Table 1:

EMPLOYMENT STRUCTURES.

<table>
<thead>
<tr>
<th>SIC orders</th>
<th>Edinburgh</th>
<th>Glasgow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Absolute</td>
<td>%</td>
</tr>
<tr>
<td>I &amp; II</td>
<td>3,000</td>
<td>1.2</td>
</tr>
<tr>
<td>III to XVI</td>
<td>57,300</td>
<td>24.0</td>
</tr>
<tr>
<td>XVII to XIX</td>
<td>43,900</td>
<td>18.4</td>
</tr>
<tr>
<td>XX to XXIV</td>
<td>134,200</td>
<td>56.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>238,500</td>
<td>100.0</td>
</tr>
</tbody>
</table>


The figures relate to persons by place of work, not by place of residence, and have been rounded to the nearest 100 absolute. The total includes workers who did not give the nature of their employers' business.

SIC = Standard Industrial Classification 1958.

Orders I and II are primary industry.

III to XVI are manufacturing industry.

XVII to XIX are construction, gas, water, electricity transport and communications

XX to XXIV are other service industries, including the armed forces and other government employees. Most central area jobs fall within these orders.
People both living & working in Edinburgh

GROSS OUTWARD MOVEMENT 11

TOTAL WORKERS LIVING IN EDINBURGH 215

TOTAL PERSONS WORKING IN EDINBURGH 238

INWARD MOVEMENTS:
GROSS 34
NET 23

FROM

Currie DC 3
Musselburgh SB 3
Rest of Midlothian 11

MIDLOTHIAN TOTAL 17

WEST LOTHIAN 6
EAST LOTHIAN 4
FIFE 3
ELSEWHERE 4

ELSELF WHERE 6

Source: 1966 Sample Census Scotland: Workplace & Transport Tables, tables 2 & 3
Figures indicate thousands of workers involved
100 mm² represents 1000 people
Although there had been previous expansions of the walled City of Edinburgh to accommodate its growth, it was still largely contained within its latest fortification, the Flodden Wall, at the beginning of the eighteenth century. The loss of Parliament and the aristocracy following the Act of Union in 1707 had a restraining effect on the development of the City, which was reinforced by the civil troubles which culminated in the unsuccessful Jacobite rising of 1745, although by this date Edinburgh was already beginning to benefit from the general expansion of the Scottish economy. The suppression of the rebellion ushered in an age of comparative peace in which the economic development of Scotland could proceed apace. Edinburgh shared in this development, and by 1752 there were already concrete plans afoot for expansion and improvement, with some action on the ground within and to the south of the Old Town. In 1767 a plan for the development of land on the ridge to the north of the Old Town was adopted, and the age of dispersal was truly begun. This first phase of expansion saw the construction of many public buildings and civil works, besides the great numbers of houses which were completed in the various developments on the northern ridge, and to some extent on the southern ridges also, at this time. From the

1. See also maps 5, 6a and 6b.
point of view of transport, the most important civil works were the bridges built to link the various hills around the Old Town over which the City was expanding. These bridges were built at the following times:

- North Bridge - 1765 to 1772
- South Bridge - following an Act of Parliament of 1785
- Regent Bridge - 1813 to 1820
- George IV Bridge - 1830 to 1834
- Kings Bridge - 1829 to 1833

The other new approach to the Old Town using the Earthen Mound was also virtually complete in its present form by 1835. Further out from the centre, the old crossing of the Water of Leith at Bell's Mills had been supplemented by a bridge at Stockbridge in the 1780s, and by the Dean Bridge which was built between 1829 and 1831.²

However, the later of these structures, and in particular the Dean Bridge, which was built to open up new feuing grounds west of the Water of Leith, did not have their potential as development stimuli realised until much later in the century. The expansionist years which had started in the 1760s came to an end in the 1830s, largely because the previous work had been on too generous a scale, but it should be noted from the population graph (figure 3) that there was also a fall in the rate of population growth in

². These dates, like much of the other information in this section, are taken from A. J. Youngson, 'The Making of Classical Edinburgh', Edinburgh, 1966. (Various pages)
this decade. As far as public works were concerned, the City was overspent, and could not afford to embark on the sort of projects to which it had grown accustomed in the previous eighty years. There was a little house building in existing streets, but few new streets were being laid out. Youngson has suggested that these years of building stagnation were due partly to the overbuilding which had taken place in the boom period. Because there was this pause in the City's growth after about 1830 it will be useful to take this date as the starting point for the present study, and to review what the city was like at this date.

Perhaps the most significant thing was that although Edinburgh had benefitted from the earlier economic growth of Scotland, the growth which was taking place in the 1830s was mainly industrial, and the City did not benefit greatly from this, despite its proximity to a well established coalfield. This lack of industry was an important factor in the lack of growth of the City at this period. It was still founded upon commerce and administration, and indeed the lawyers who served the Scottish Courts formed a significant part of the population.

Although commercial uses, including banking, had, by 1830, spread into the New Town along Princes Street as far west as Hanover Street, and were beginning to appear in St. Andrew Square, the greater part of the City's income generating activity still took place in the Old Town. The principal

markets were to be found at the foot of the slopes down from the Old Town under the North Bridge along the banks of the mire known euphemistically as the Nor'Loch. Up on the ridge along the ancient High Street were to be found the Law Courts and the Merchants' Exchange. Moreover, the building of the New Town had not included dwellings for the working classes, so that although some of the fringe areas of the new development, notably St. James Square, had soon 'gone downhill', the bulk of the labouring poor were constrained to live in insanitary conditions in the closes of the Old Town and the Canongate which their more prosperous 'superiors' had vacated for the salubrious life of the New Town or the new southern suburbs. There was a severe shortage of accommodation for these 'lower' classes, and overcrowding was increased by the arrival of new elements, such as the navvies who built the Union Canal around 1822 and who stayed to be involved with the railway era.

Overland transport had improved sufficiently for the development of a network of stage coaches, but bulk haulage of low cost goods such as coal and grain presented a problem. Leith had long been a very significant port with a large coastwise trade, both within and without the Firth, but it was thought worthwhile to construct the Union Canal in from the Forth and Clyde Canal at Falkirk to its Edinburgh terminals at Port Hopetoun and Port Hamilton, giving much improved access from the west and the rapidly growing Clyde

4. George Square, Newington, etcetera. See section2F.
Valley for both passengers and freight, especially coal and agricultural products. These terminals, coupled with the new approaches from them to the Old Town then under construction, had given a boost to the development of this part of town, although it was not yet on a scale comparable to either the New Town or the less formal (and cheaper, being outside the Royalty of the City with its higher rates and taxes) southern suburbs. On the then fringes of this area adjacent to Holyrood Park a new transport departure for Edinburgh was inaugurated in 1830 in the form of the St. Leonards terminus of the Edinburgh and Dalkeith Railway, along which horses drew coal from the mines of the Dalhousie area to the City to supply its growing demand for fuel. The horses also drew passenger coaches which were, by the 1840s, carrying over 300,000 passengers per annum to and from Dalkeith and Fisherrow (a later branch serving this last destination). This line was later upgraded and incorporated into the system operated by the North British Railway.

The City was still one in which it was practicable to go anywhere on foot, although any boy who had to travel daily from the southern suburbs to the recently opened Edinburgh Academy at Canonmills on the opposite fringe of the City might have quarreled with this remark. Many places now included in the City, including the ancient port and town

6. See section 2E.
of Leith and the infant settlement of Portobello, which later
developed as an important City resort\textsuperscript{7}, then still formed
distinct settlements. The Burgh of Leith, then almost
entirely confined to the north of Junction Street and the
Links\textsuperscript{8}, was still a vassal of the Corporation of the Royal
Burgh of Edinburgh, and its development suffered from this.
However, it gained its independence and its own administration
after the Reform Act of 1833. In the oppressive control
which the City of Edinburgh imposed on Leith before this
reform can be seen the origins of the enmity which persisted
between the two burghs right down to the time of their
amalgamation in 1920 and even later, an antagonism which
seems to have had some effect on the development of both.

Around 1830 Edinburgh was at a turning point in its
development. The great expansion which had taken place in
the building of the New Town, at least that part of it
between Broughton Street and Queensferry Street, including
the lands developed by Henry Raeburn west of the Water of
Leith at Stockbridge, was spent, and a period of stagnation
lasting longer for building than for population was about to
follow before the next period of expansion. Yet at Port
Hopetoun and St. Leonards there were the beginnings of the
new transport technology which was to allow the town to grow
beyond the confines of a purely pedestrian city when the
time came for it to do so.

7. See section 21.
8. See map 18, also section 2H for more detail about Leith.
NOTE: The Mound was created by spoil dumping during construction of New Town.
1. The Flodden Wall was approximately along the limits of the Ancient Royalty as shown on this map.

2. Not all the railways shown on the map were in use at the same time. When the diversion route to Granton and Leith via Abbeyhill was opened in 1868, Scotland Street station became a coal yard, and the line southwards through the tunnel thence to Waverley was abandoned. For fuller details see pages 70-1 and map 12 below.

3. The roads shown on this map are those which today form principal traffic routes, and other roads which are referred to in the text, although the choice was not as strict as this definition implies.
In the previous section it was suggested that about 1830 there was a change in the manner of Edinburgh's growth. The increase in population which the graphs (figure 3 et seq.) show to have been proceeding quite rapidly during the previous decades suddenly stopped, and there was little change in the population total in the decade 1831 to 1841. After 1841 the graphs again show an increase which, although quite rapid until 1901 for the City as a whole, did not for that area ever again reach the rates of growth attained before 1831. In the twentieth century there has been a markedly lower rate of increase, and within the present administrative boundary of the City the most recent census figures show even a slight decline.

This raises the point that the administrative extent of the city does not necessarily reflect other aspects of its growth. However, in the past Edinburgh's boundaries have been extended several times so that there has been some match between the area administered by the City and its population. Sometimes these extensions have followed the

9. For Portobello this phase appears to have occurred ten years later, in the intercensal period 1841 to 1851.
1. Census of Scotland, various years. The decline occurs after 1961. See also table 2 and graphs.
2. See map 7 and figure .

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The boundary of Leith Burgh, created in 1833, appears to have been constant until its absorption in 1920.

NOTE: This map relates to Municipal Burghs only.

Dates of extensions of City:

- C 1856
- D 1882
- E 1885
- F 1890
- G 1896
- H 1900
- J 1901
- K 1920 & later

- Extended Ancient Royalty of the City 1830
- Later Boundaries
- City Boundary 1920 (unextended)
- Coastline
- City Boundary 1972

[Map showing the boundaries of the City of Edinburgh with dates of extensions and symbols for different periods of city expansion.]
Figure 2
EDINBURGH MUNICIPAL EXTENSION

For acreages see next sheet
See also text and map 7

Source:
Edinburgh 1329-1929, pp.212-232

Scale: *100 acres
The Ancient Royalty was 138 acres in extent, and the Extended Royalty 460 acres, so that in 1830 the Royal Burgh comprised 598 acres. The additions are shown in the following table.

<table>
<thead>
<tr>
<th>Year of addition</th>
<th>Acreage added</th>
<th>Cumulative acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1856</td>
<td>3,966</td>
<td>4,564</td>
</tr>
<tr>
<td>1882</td>
<td>1,302</td>
<td>5,866</td>
</tr>
<tr>
<td>1885</td>
<td>95</td>
<td>5,961</td>
</tr>
<tr>
<td>1890</td>
<td>174</td>
<td>6,135</td>
</tr>
<tr>
<td>1896</td>
<td>2,468</td>
<td>8,603</td>
</tr>
<tr>
<td>1900</td>
<td>1,462</td>
<td>10,065</td>
</tr>
<tr>
<td>1901</td>
<td>812</td>
<td>10,877</td>
</tr>
<tr>
<td>1920</td>
<td>21,525</td>
<td>32,402</td>
</tr>
</tbody>
</table>

Plus some small additions after 1920 to bring the present acreage to 33,294 acres (1966 Sample Census, County Report, table 1).

The acreages up to and including that for the 1920 extension are from the source quoted on the figure.
growth of the City, as with the 1856 extension, but on other occasions they have anticipated it, as in 1920 when large undeveloped areas were included within the City. It seems, however, that each of the more confined areas of the City have reached a peak population and then lost some of it as densities have declined. Line C of figure 5, for example, suggests that the old core of the town in the Ancient and Extended Royalties reached its peak population about 1850 and then began to lose it. Again, the 1951 Census report on Edinburgh suggests that the population of the City of Edinburgh and the Burgh of Leith, as defined before the 1920 boundary changes, had dropped from about 405,400 in 1931 to about 352,000 in 1951. This suggests that the areal extension of the built-up area of the City is due in some measure to an outward movement of population from its inner areas, which would in its turn result in a lowering of residential densities in the centre.

Flexibility in the intensity of residential land use such as has just been suggested means that there is a minimum of linearity in the relationship between the extent of the built up area and the size of the population. For example, there seems to be a consensus among the historians of nineteenth century Edinburgh that the lack of provision for working class housing combined with increasing numbers of these people led to increases in densities in the closes of the Old Town.

3. The area of the City before 1856. See map 7.
despite the contemporary extension of the built-up area. In contrast the enormous expansion in the extent of the housing areas of the City since 1920 has been accompanied by virtually no change in the population total. Part of the explanation for this expansion may be found in the loss of some former residential land to other uses, notably in the business and University areas of the city centre, but in comparison with the acreages taken in for new residential development these losses are small. More important reasons for the expansion include:

a) The construction of fewer houses per unit of area in new housing developments than in those of the nineteenth century working class areas. The effects of this may be seen on map 8 by comparing the resultant population densities in recent developments such as Muirhouse in the north-west of the City with those in the inner industrial suburbs such as Dalry.

b) Reductions in the intensity of use of existing dwellings as illustrated by the following table of persons per room: 5

<table>
<thead>
<tr>
<th>Year</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1871</td>
<td>1.34 (All households)</td>
</tr>
<tr>
<td>1911</td>
<td>1.20 (&quot; )</td>
</tr>
<tr>
<td>1921</td>
<td>1.18 (Private households only)</td>
</tr>
<tr>
<td>1931</td>
<td>1.11 (&quot; )</td>
</tr>
<tr>
<td>1951</td>
<td>0.94 (&quot; )</td>
</tr>
<tr>
<td>1961</td>
<td>0.85 (&quot; )</td>
</tr>
</tbody>
</table>

5. Based on Census of Scotland County Reports for Edinburgh, 1931, table 28; 1951, table 20; 1961, table 34, column n.
c) Changes in social structure leading to smaller family units each requiring a separate house.

After the second World War housing land within the City began to get scarce, and what was available was located at a considerable distance from the city centre. Hence there has been a tendency for the rate of decrease in the residential land use intensity to slow down in recent years, and indeed in some parts of the City, such as Grange, where there are large houses with spacious grounds there have been infill developments which have locally raised the land use intensity. However, despite the shift away from the policy of relatively low densities which had prevailed in the 1920s, a shift which will be more fully described in section 2K, new developments are still at considerably lower densities than the slum housing areas being cleared, so that the overall intensity of residential land use is still falling. The increasing availability of transport, public and private, since 1920 has been a key factor in making these changes possible.

However, there is a limit to the flexibility of housing density, and when, as in Edinburgh from the 1760s onwards, the density at which any economic group of the population whose numbers are expanding is living is at the limit which that group will tolerate, there will have to be an increase in the area their housing occupies. Thus a growth in absolute numbers is not wholly to be discounted as a reason for the growth of the built-up area of the City, particularly in the nineteenth century.
For the purposes of this study it is not relevant to ask why the population total of Edinburgh grew: it is sufficient to note that it did, and in what degree. However, it is relevant to consider the effect that the availability of public transport had on the acceptable level of density. Most importantly in this respect, it would have been impossible to contemplate the dispersal that did in fact take place without the existence of some form of passenger transport. The size of population attained is within the maximum postulated for a city dependent solely on pedestrian movement⁶, but, thanks largely to the public transport system outlined in the following section, the density is much lower than such a city would require.

Table 2;

POPULATION 1801 TO 1971

<table>
<thead>
<tr>
<th>Year of Census</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
</tr>
</thead>
<tbody>
<tr>
<td>1801</td>
<td>82,560</td>
<td>67,288</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1811</td>
<td>102,987</td>
<td>82,624</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1821</td>
<td>138,235</td>
<td>112,235</td>
<td>51,768</td>
<td>60,467</td>
<td></td>
</tr>
<tr>
<td>1831</td>
<td>161,909</td>
<td>136,054</td>
<td>54,992</td>
<td>81,062</td>
<td></td>
</tr>
<tr>
<td>1841</td>
<td>166,450</td>
<td>138,182</td>
<td>56,330</td>
<td>81,852</td>
<td>132,977</td>
</tr>
<tr>
<td>1851</td>
<td>193,929</td>
<td>160,511</td>
<td>66,734</td>
<td>93,777</td>
<td>160,302</td>
</tr>
<tr>
<td>1861</td>
<td>168,121</td>
<td>66,429</td>
<td>168,121</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1871</td>
<td>196,979</td>
<td>62,171</td>
<td>196,979</td>
<td></td>
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<td>322,465</td>
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<td>1971</td>
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Notes on next sheet.
Table 2 (continued)

Column headings

a. City including North and South Leith parishes. The population in this line was given under various heads, e.g. City and Town, City and Burgh, City.
b. City excluding North and South Leith parishes.
c. Royal Burgh (Ancient and Extended Royalty).
d. Suburbs, which included various parishes as described in the census reports, all now included in the burgh.
e. Parliamentary Burgh, extended 1884 and 1918 (excludes Musselburgh which was in the East division of the burgh from 1918 to 1948).
f. Municipal Burgh.
g. Town.
h. Municipal Burgh.
j. Parliamentary Burgh.
k. Village.
l. Parliamentary Burgh (1841 to 1911 censuses) and Municipal Burgh (1841 to 1891 censuses).
Notes

Source: 1951 Census of Scotland, Edinburgh County Report, Table 2, p.22.

The figures for 1961, 1966, and 1971 are the enumerated population for Edinburgh City at those censuses taken from
1961 Census, Edinburgh County Report, table 3a, col.d.
1966 Sample Census, County Report, table 1.

* There was no census in 1941.

** 10% sample census, the figure given implies that 46,234 people were actually enumerated, and this may be taken to mean that the total population was about 462,340.

For details of boundary changes which affect the figures and their comparability over time, see section 2D and map 7 adjacent to this table.
Figures 3, 4 and 5.

General note.

These three figures have a common logarithmic vertical scale and a common horizontal scale, along which a mark indicates each year in which a census was taken. Hence the graphs are comparable throughout, with equal gradients representing equal rates of change of population.
A - A; Derived from the information as given on table 2 adjacent by subtracting 'City excluding North and South Leith parishes' from 'City including North and South Leith parishes' (on table 2, col. a - col. b)

The populations plotted are as follows:

<table>
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<tr>
<td>1801</td>
<td>15,272</td>
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<td>1811</td>
<td>20,363</td>
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<td>26,000</td>
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<td>1831</td>
<td>25,855</td>
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<td>1841</td>
<td>28,278</td>
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<tr>
<td>1851</td>
<td>33,418</td>
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B - B; Derived from column j of table 2, Leith Parliamentary burgh

C - C; Derived from the Census of Scotland 1961, Edinburgh County Report, table 3a, columns c (1951) and d (1961), this line shows the total population of West Leith, Central Leith and South Leith wards in 1951 and 1961, with the rate of change projected back to 1931. The area concerned is smaller than was Leith burgh, but the 1948 boundary changes make a direct comparison impossible between the present wards and those before 1948, which preserved the old burgh boundary intact.
Notes.

1821 to 1911; Derived from information given on table 2 adjacent. 1821 and 1831 are 'Portobello village', column k on the table, and 1841 to 1911 are 'Portobello Parliamentary burgh', column l on the table.

1921; Population of Portobello ward of Edinburgh City as given in the 1921 Census County Report, table 4 (18,680 people).

1931; Population of Portobello ward as given in the 1931 Census Edinburgh County Report, table 4 (26,145 people).

1951; Population of Portobello ward (1948 boundaries) as given in the 1951 Census Edinburgh County Report, table 4 (23,486 people).

1961; Population of Portobello ward (1948 boundaries) as given in the 1961 Census Edinburgh County Report, table 3a (27,141 people).

The dotted sections of the line indicate discontinuities in the data. For 1911 to 1921 the two figures relate to approximately the same area of housing, but the discontinuity caused by the ward boundary recasting in 1948 cannot truly be bridged.
Figure 5:
Notes.

All information is as on table 2 adjacent, and columns refer thereto.

A - A ; An approximation to the total City population, as follows;

1801 and 1811 ; 'City including North and South Leith parishes' (col.a)
1821 and 1831 ; As 1801 and 1811, plus Portobello village (i.e. col.a + col.k)
1841 ; 'City excluding North and South Leith parishes' plus 'Leith Town'
plus Portobello Burgh (col.b + col.g + col.l)
1851 to 1891 ; Sum of Edinburgh, Leith and Portobello Parliamentary burghs (col.e + col.j + col.l)
1901 and 1911 ; Sum of Edinburgh and Leith Municipal burghs (col.f + col.h)
1921 to 1971 ; Edinburgh Municipal burgh (col.f)

B - B ; The Edinburgh component of line A - A

1801 to 1871 ; 'City excluding North and South Leith parishes' (col.b)
1881 to 1931 ; Edinburgh Parliamentary burgh (col.e)

C - C ; The Royal Burgh (Ancient and Extended Royalties (col.c))
As was stated in the previous section, it was the availability of public transport which allowed Edinburgh to expand areally beyond the limits of effective pedestrian circulation after the middle of the nineteenth century. In discussing the changes that took place in the development of the City after the end of the 'Classical' phase of its history, Youngson writes

'The great transport innovation was of course the railway. It is true that in a sense railways made less difference to Edinburgh than to most towns of any importance. Their introduction did not lead in Edinburgh's case to a great expansion of manufacturing activity nor did it put the City on a newly created trade route. The general development of railways around and into Edinburgh was gradual and the results unspectacular, but the railways did have an important and obvious effect on the economic geography of the centre of the town.'

In general one can agree with this statement and, as will be shown in the later sections of this chapter, in the case of the growth of the residential areas of Edinburgh the role which the railway played was in general less than that of

road transport. It is probably true that because the horse 'bus, stage coach and horse tram have long disappeared from the urban scene modern man tends to underrate their earlier importance. There was a regular coach service between Edinburgh and Leith as early as 1610, and when the immediate suburbs began to spread beyond a comfortable walking distance from the town centre, several local operators provided a system of horse 'bus routes which was well developed by 1870. In this year Parliament passed the first Tramways Act, which laid down an economic procedure for obtaining tramway powers, and which can be taken as marking the opening of the tramway era. Edinburgh soon benefitted from this Act, with powers being granted to the Edinburgh Street Tramway Company in 1871 which led to the opening of the first service, from the Haymarket via Princes Street to Bernard Street in Leith, in November of that year. From that time down to 1947 the tramway system in Edinburgh and its vicinity was generally expanded, and played an increasingly important part in the life of the City, although it suffered many vissicitudes on its way. The principal of these problems was that the burghs of Edinburgh and Leith exercised their right of purchase of the tramways, following the procedure established by the 1870 Act, at different times, and further they chose


9. As with all facts in this section, unless otherwise stated, the information is from D. L. G. Hunter, op. cit. 1964.
to use different forms of mechanical propulsion, so that, although the systems were of the same guage, there was no through working of cars between Edinburgh and Leith from 1899 to 1922. By this latter date the two Burgh Corporations had been amalgamated, and the cable system of traction hitherto operated in Edinburgh was being changed to the more conventional electric power which Leith had adopted in 1905.

Edinburgh was also very early provided with motor omnibus services, although the earliest experiments from 1898 were financial failures and hence shortlived. The SMT company's first services were successfully begun in 1906, and by the time of the first World War there were services on most of the radial routes westwards and southwards from the City. In 1919 the Corporation, after a false start in 1914, began to operate motor 'bus services also, and the two operators soon came to a working agreement which has survived, with modifications to suit changed circumstances, to form the basis of the present working agreement between the Corporation and Scottish Omnibuses Limited. Within the City the 'bus system evolved slowly but surely during the 1920s and 1930s, proving a very useful means of serving the new council housing schemes which lay too far off the existing tram routes to be adequately served thereby (see section 2K). After 1947

2. The 'bus operations of SMT became 'Scottish Omnibuses Ltd.' (SO Ltd.) in 1948 after severance from the parent company.
NOTE: This map refers principally to the evolution of the ECT network of routes. SMT (later SO Ltd.) began services on the main radial roads 1906 to 1914 (see text). Horse 'bus' services are not included.

Bus routes (as at 1st January 1972)
- Converted from tramways 1952-6
- ECT begun 1919 to 1945
- ECT begun since 1945
- SOL Ltd (not served also by ECT)
- Coastline
- City Boundary 1972
the number of people travelling on the trams began to fall, although the total passenger carryings of the Corporation's transport undertaking did not peak for another three years, and between 1952 and 1956 the trams were replaced with 'buses, which were probably better suited to the traffic and urban development conditions then obtaining. Subsequent development of the system has left Edinburgh with a coverage of 'bus services unrivalled for accessibility to the citizens except possibly by Aberdeen and Birmingham.\(^3,4\)

Railways in Edinburgh began as a means of getting coal into the City from the Dalkeith area, but the Edinburgh and Dalkeith Railway seems to have carried passengers from the time of its opening in 1831.\(^5\) Locomotive haulage arrived with the Edinburgh and Glasgow Railway, opened in 1842,\(^6\) and subsequent developments left the City with a complex network of lines belonging to two companies, the North British Railway and the Caledonian Railway. As with other forms of transport in the nineteenth century, one of the significant local aims of the railways was access to Leith,


4. The extent of this coverage is shown on map 11. See also map 9 for tramway history, map 10 for motor 'bus history and map 12 for railway history.


and passenger carryings between the two burghs, although little attention was paid to intra-urban services until the latter part of the century. For many years, Leith was served, originally via Scotland Street but later via Abbeyhill, by a branch off the main line from Edinburgh (Waverley) to Fife which ran down to Granton Harbour and the train ferry thence to Burntisland, which was the chief rail crossing of the Firth until the Forth Bridge was opened in 1890. In the last quarter of the century several lines were developed to cater for the Leith service, and a number of other branch lines were opened within what are now the City limits, including the Edinburgh South Side and Suburban line opened in 1884 to serve the southern suburbs.

The early horse 'buses and trams were expensive to ride in, and moreover the services in 1870 did not commence until nine o'clock in the mornings. In consequence these were not means of travel available to the working classes for they could not afford the fares, and moreover they needed to be at work well before the services started in the morning. There were some improvements in the situation under the Acts authorising the construction of the tramways which provided for the operation of cheap fare workmen's services in the mornings on each route. The railways were sometimes cheaper and also quicker, than the trams, as between Edinburgh and Leith in 1876\(^7\), but the trains were never frequent, the fifty-four services daily from Edinburgh (Waverley) to Leith Central

which Hunter quotes for the 1914 timetable probably representing
the maximum intensity of service regularly operated. 8

After the first World War the extension of the motor
bus network and the reduction in the level of tram fares
swung the competitive balance between road and rail forms of
public transport in favour of the former. Some railway
routes, notably the lines to Leith and the South Side and
Suburban, had an inherent disadvantage in that their routes
were circuitous, and all suffered from relatively infrequent
services. Thus, even though the railway managements made
an effort to retain traffic, the railway system in general
played a decreasingly important role in the City's public
transport system. 9 War and material shortages in the 1940s
began the cutting back of the system, and the services which
did survive tended to be operated in business hours only.
Today there are only four railway passenger stations open
in the City, two serving the central area and two unimportant
suburban ones, as compared with three in the central area
and thirty three others in 1936. 1

The private motor car appeared on the transport scene
in significant numbers before 1939, but it was not until
the 1950s that there were enough about for the total

9. But see section 2K for an exception, the successful new
Halt opened at East Filton.

1. 'Edinburgh Studies', Institute of Public Administration,
passenger carryings of the Edinburgh Corporation Transport Department to begin to contract. Rising levels of car ownership coupled with rising labour costs which have been reflected in rising fares have brought about a swing away from public transport which has been aggravated by the problems of congestion delay that increasing numbers of vehicles have brought, and by the reduction in service frequency that accompanies the contraction in demand in an unsubsidised transport system. However, car ownership levels in Edinburgh are still low compared with those in some other British cities, so that the public transport system remains adequate and generally well patronised, although it is still losing passengers. In chapter 3 the solution of the problems which have arisen partly from this shift in the modal split will be discussed, but it remains to remark here that the 'buses remain as far from omnibuses as ever, although it is now the richer citizens who do not use them and the poorer who do, constrained as they are by an inability to live close to their work and by a lack of private transport.
THE DEVELOPMENT OF SOUTH EDINBURGH.

It was indicated earlier in this chapter that the development of Edinburgh southwards had started even before the New Town was begun, and it may be noted that some of this area, in particular George Square, remained the most fashionable part of Edinburgh for a considerable time after the New Town had been established. The building of the South Bridge around 1785 made access to the area from the Old Town across the steep-sided valley of the Cowgate less difficult, and was a great boost to the development of the area, but it may be noted that even by 1771 the area was populous enough to justify the appointment of Police Commissioners, who dealt with watching, lighting, and paving. However, even with the Police Rate these Commissioners levied, there were financial advantages in living in this area outside the Royalty of the City and hence not subject to its rates and taxes. In 1806 feuing began in the Newington area, and by 1815 there was enough villa development between Salisbury Road and Mayfield Loan for a contemporary commentator to consider it a phenomenon worthy of remark. These developments

2. See map 13.
4. These southern suburbs were not included in the Burgh for municipal purposes until 1856.
suited those who wanted to live like country gentlemen, in contrast to the Classical urbanity and sometimes spectacular expense offered by the New Town. This is illustrated by the successful gimmick of estate gates closed at night employed by the developers of the Blacket estates, who commenced work in 1820. By the time of the building hiatus of the 1830s and 1840s there was a substantial suburb along the roads leading to the South Bridge. The farthest villas were over a mile from the city centre, and thus could be said to be near the limits of a purely pedestrian city. The suburb of Boroughmuirhead had begun to develop in a small way by this time, but access to the centre of town was not yet very good, with the George IV Bridge and the Kings Bridge being built only in the early 1830s. Moreover, the distances from the town were in any case rather more than many folk would want to walk too often.

When building revived in the 1850s, South Edinburgh expanded more rapidly than other parts of the City, so that by 1870 almost all the present streets between Grange Loan and the Old Town had been laid out. The Warrender Park area was an exception because it surrounded Bruntsfield House which was occupied by the Warrender family who were reluctant to sell or let their land for building. However, by the 1880s the pressures for development had become so great that even Warrender Park was feued, and Bruntsfield House became closely surrounded by the advance of the suburbs.

6. See map 5 for the extent of the City in 1870.
The Merchiston area was developed at much the same time and in much the same style as the areas further east.

In the early years the characteristic form of house built in South Edinburgh was the villa standing in its own grounds, and many of these were quite large buildings with coach houses which indicate wealthy occupiers. However, much of the later building, including that on the Warrender lands, took the form of tenements for middle income occupiers. This change in the form of development can probably be attributed, in part at least, to improvements in the accessibility of the area which opened it up to a wider public. Areas within walking distance of the city centre, such as the south-eastern fringe of the Meadows, appear to have been built up with tenements fairly early, but in most other parts of the area the construction of this higher density form of housing came after 1870. By that year there were quite good horse 'bus services along the principal roads linking the area with the city centre, although these suffered the limitations of times and costs already mentioned. 7 In 1872 the public transport situation was improved further by the opening of the first tramways into the district. These ran from the GPO at the east end of Princes Street via Salisbury to the Powburn 8, and from the existing Princes Street to Haymarket route via Tollcross and Church Hill to Salisbury. In 1883 an extension from Church Hill to

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7. See p. 71.

8. Near what was to become Newington Station.
Morningside Toll was opened. There can be no question that by the 1870s the South Side was the most fashionable residential area of Edinburgh, and a very large part of the City's building activity at that time was concentrated there. Most types of housing for upper and middle income groups were being built, although there appears to have been a tendency to build tenements in the most easily accessible areas, with villas elsewhere. This is not to say that all the land close to the tram routes was developed, and even such accessible sites as the lands east of and immediately behind Morningside Road were left for later development. In the Powburn area, despite the tram service, villa development continued although tenements were erected in Dalkeith Road and Mayfield Road. One may surmise that the improved public transport services in South Edinburgh were part of the stimulus which produced tenements on a large scale in this area in the last decades of the nineteenth century, but it is clear that there was no direct cause and effect relationship between the two phenomena. Indeed the Warrender Park area, which comprises one of the main tenement concentrations, is close enough to have developed as it did purely on the basis of pedestrian communication with the city centre.

It was at this time that the Edinburgh South Side and Suburban Railway was proposed and constructed, being opened in 1884 with stations at Newington, Blackford Hill and Morningside Road in the South Edinburgh area. Because of the topography this line runs transversely to the radial
roads from the City, curving round through Gorgie to approach the centre from the west, serving Haymarket and Waverley stations. The psychological effect of the indirect route taken by the railway must have been a deterrent to its use, although the times taken to reach Waverley were not excessive. Since there was only an hourly service in each direction, as compared with the trams running every five or ten minutes from both Morningside and Newington, setting down at a lot of places in the city centre rather than just two, the impact of the railway on the development of South Edinburgh must be in doubt. However, a few tenements were erected close to Blackford Hill station, where the railway was not in competition with the trams, and here the railway may have been one of the attractions of the site.

In the 1880s there was a very large scale development of the land south of Morningside station. This Plewlands estate was being advertised in 1886 as follows;

"Plewlands Estate, Morningside - The attention of builders and others is specially directed to this estate which affords admirable sites for VILLAS, small"

9. The centre could also be reached in the other direction via Portobello, but this was a long way round.

1. 23 minutes from Newington, 17 minutes from Morningside Road. The distance would also adversely affect mileage based fares.

SELF-CONTAINED HOUSES, and COTTAGES. These, from the Railway Station and Tramway Terminus now upon the estate are sure to sell readily. Fees moderate. Couper and Cook, 37 George Street. 3

Obviously the transport provision was felt to be an important sales feature at this date, but in the actual letting advertisements at the time it played a relatively small part. Presumably the prospective tenants were expected to know about the transport arrangements in the area where they were seeking a house. In fact the development in this South Morningside area, and in particular Craiglea Drive, Morningside Drive and their associated roads, shows some quite interesting features. Firstly, the type of house in these streets, the short terraces of two-storey dwellings, is rare in contemporary developments in the City on the scale found here. Secondly, the rate of development was very rapid for the time. In many ways this group of streets is a forerunner of the type of development which became the norm for private builders in the 1930s. 4 Finally, it is interesting to note how far from the tram route the development took place. When it was first occupied in 1888 St. Clair Terrace was effectively half a mile from public transport, and even after the extension of the tramway in 1897 these houses were not within five minutes walk of it, despite being intended for people without private

3. Advertisement in the 'Scotsman' newspaper, 16th October 1886, p.3, column 7. 'Land to feu'.

4. See section 2K.

- 79 -
means of transport.

By the 1890s the southward extension of the City was beginning to lap around the slopes of Blackford Hill, and this, with other limitations of topography, caused a deceleration of development in this direction, so that in the last decade or so before the first World War it was reduced almost to a process of filling in the existing matrix. In Edinburgh generally there seems to have been a deceleration of building at this time, and this too would have been a contributory factor in halting the southward march of dwellings. In 1897 the tramways were extended to Nether Liberton and to Braid Hills Road as a part of the mechanisation programme, and these two termini may be taken as representing the limits to which the buildings in South Edinburgh reached before the great expansion of the City which took place in the 1920s and later. Once mechanised, the trams became even more dominant in the transport scene, and in consequence even the Blackford Hills horse 'bus, although not competing with the trams, disappeared. Yet the trams were still predominantly a middle class form of transport, too expensive for the working class's regular use. They undoubtedly played a key role in making places like Morningside accessible enough to become popular places to live in for those who could afford it, but it does no harm to reiterate that there was no direct causal relationship between the presence of

5. Again see section 2K.

6. Running by the present service 41 'bus route from the Mound.
such forms of public transport and the pattern of housing development.

At the end of the nineteenth century the near monopoly of development in Edinburgh which had been held by these southern suburbs for several decades was broken. Other areas ripe for development were now nearer the city centre, and equally accessible to it, so that despite the fashion which had for so long helped the southern areas, these other areas now began to develop because they were now for practical purposes in a more favourable position to expand than Morningside. Moreover, the little villages in the country round about the City, particularly on the western side, began to develop into suburbs, although remaining physically distinct from the City for several more years. It is to a consideration of these other developments that the discussion turns in the following sections.
Although the construction of the Kings Bridge had made access to the Old Town from the west easier than it had been, it was opened at the start of the pronounced building hiatus of the 1830s and 1840s. In consequence of this, and of the overwhelming popularity of South Edinburgh in the middle decades of the nineteenth century, the development of the middle and upper income western suburbs did not begin in earnest until about 1880 or even later. The earliest tramway into this area ran only to the Haymarket, being opened thither from the General Post Office in 1871. It was extended to the Water of Leith at Coltbridge in 1873, but this section justified only a sparse service in its early years, and development in the area it served was slow until the 1890s, developments at which time included the 'West Coates' group of streets. By 1897 extension of the tramway to Murrayfield Road and the City boundary was felt justified, and by 1911 the 'tramway suburb' of Murrayfield, with its good quality villas and terraced houses, was virtually complete. The distances from the city centre involved here are comparable to those in South Morningside, so that some form of public transport to make the area more readily accessible from the main areas of employment and city life was a prerequisite for its development. The usefulness of

7. See maps 14, 15, 16 and 17.
the Caledonian Railway's service between Murrayfield and Princes Street stations which had been available since 1879 was restricted because it deposited its patrons at some distance from the then heart of the City, whereas the tram, which was already available when the railway was opened, passed right through the heart of both Old and New Towns on its way to Salisbury. Thus the fact that the great expansion of Murrayfield took place at the time the tramway was extended, coupled with the fact that here, unlike in Morningside, few streets were laid out far from the tramway, suggests that the relationship between the extension and the development was hardly coincidental.

Meanwhile industrial development between the Union Canal and the Edinburgh and Glasgow Railway was proceeding apace. Rubber processing, brewing and distilling were the main sources of employment, and some of the works were large by the standards of the time. In the early 1880s the two rubber works, an industry which like the Caledonian Distillery had been established in 1855, employed about a thousand people, exclusive of outworkers, when in full production. These large factories, plus later establishments such as the North British Distillery at Tynecastle, coupled with the several railway yards and depots which were built in the area from

the 1840s onwards, employed a substantial amount of labour in an area out of reach of established areas of suitable housing within the City. Hence there grew up between the railway yards and the factories several substantial pockets of working class housing, which show up as areas of high population density on map 8. This development was rapid, and by 1891 streets were being laid out as far west as Shandon Crescent on Slateford Road.

The impact of public transport on such development was almost certainly small because of the powerful symbiotic ties between its residential and industrial elements. People did not need, and, bearing in mind their economic status, could not afford, to travel very frequently by either tram or train. The fares were expensive in relation to the labourer's or artisan's wages, and probably even leisure travel, such as there was time for, would have commonly been made on foot. It must be admitted, however, that the large contemporary carriers of bulk freight, both railway and canal, had a very strong bearing on the location of the factories, and hence of the residential development. In this sense public transport was important, but in the sense of public transport as a passenger carrier with which this study is concerned, even its presence was probably unnecessary since the area was so self-contained. However, public transport did enter the area, and it does not seem to have been unsuccessful although the odds were not in its favour.
Merchiston station on the Caledonian Railway's main line out of Princes Street station was opened in 1882, and the more useful local station on the South Side and Suburban line at Gorgie East followed in 1884 when that line was opened. However, tramway extensions along Dalry Road to Ardmillan Terrace and thence by way of Harrison Road to Polwarth, and from Tollcross via Gilmore Place and Polwarth Terrace to the latter's junction with Colinton Road were opened in 1882 and 1883. These tramways gave a better service to the areas they served than did the railways, at least in terms of frequency and accessibility, but the effect of the Dalry route on the course of urban development is, as has been suggested, open to question.

On the Polwarth fringe of this industrial quarter, where it merges with the higher income residential area of Merchiston, the tram may have been a more relevant introduction, but from later events it seems that even so the Dalry route was the more successful. However, the section of this route beyond Ardmillan ran through an undeveloped area, apparently with the aim of stimulating development along Harrison Road, and appears to have been unsuccessful. Few regular services ever ran over the Harrison Road section, which was soon abandoned, and it was another decade before the street appeared in the 'Post Office Directory', indicating that development had probably not until then taken place. The main part of the Dalry route was, however, included in the

main programme of changeover to mechanical traction in the late 1890s, and was extended from Ardmillan to Gorgie at this time. On the other hand the Polwarth trams remained horse-drawn until 1907, largely because the area they served had grown so slowly that there was insufficient traffic to justify the conversion at the earlier date. The installation of the cable on the Polwarth route was accompanied by its extension to Craiglockhart as part of a programme in which the Corporation, now owners of the tramways, seemed bent on extending all the routes to the then City boundary, presumably in an effort to stimulate development. At this stage in the City's history there seems to have been a falling off of both population increase and building after forty years of steady growth which could well have given rise to such a policy.

Whilst this growth of suburban areas contiguous with the City was taking place, country villages close by were developing into suburbs. The railway up the Water of Leith, with its stations at Colinton and Juniper Green, was opened in 1874. In the vicinity of these two places the Water of Leith is in a deep valley and falling quite steeply, giving a series of mill sites, but the industrial development of this valley does not account for more than a small proportion of the residential development that took place there around the turn of the century, as for example on the south-facing slope between Colinton Church and the Lanark Road. There are too many too big houses here for them to have been merely the dwellings of leading industrialists of the locality.
Rather, these two villages, and Colinton in particular, were developing as middle and upper income suburbs of Edinburgh, a character which is to a certain extent retained in some of the latest developments in the area. The railway service of nine trains each way in 1887 and fifteen trains each way in 1910 was, although not generous, at least adequate for people who could afford to own or hire road transport for journeys they could not make by train, and the presence of the railway service must have been a factor which allowed the development of this area before it was provided with public road transport.

Another place in the country close to Edinburgh which developed at about the same time as Colinton and Juniper Green was Blackhall. There had been a famous quarry here at Craigleith for quite some time, and some of the oldest houses in Blackhall today are of a type which suggests an association with the quarry workforce. Craigleith station on the Caledonian Railway's Leith and Barnton branches was opened in 1879, and by 1910 there was a good service to Princes Street of at least two trains per hour, and also at least one train per hour to Leith. There was also a good motor 'bus service provided by the SMT company between Edinburgh and Queensferry serving the area from a very early date, with short workings to cater for the local traffic at

2. 'Bradshaw's August 1887 Railway Guide', op. cit.
4. Loc. cit.
the busiest times. It is not surprising therefore that with the conjunction of these factors Blackhall should have been a nucleus for development in what became the north-western suburbs of Edinburgh. However, the development at this date was in fact sited away from the station, suggesting that the latter's influence was not the only factor involved in the former's location.

The most interesting of these western suburban developments before 1920 was, however, at Corstorphine. Although there was a station on the Glasgow main line near the site of the present Saughton Junction, this was too far from the old village and too poorly served by trains to be of any significance in the history of the area's development. Even so, by 1902 when the North British Railway opened the branch line which latterly served the village, there was a substantial community here which had grown from a population of 1,500 in 1851\textsuperscript{5} to over 2,300 in 1891\textsuperscript{6}, and which was still expanding. Thus it appears that the branch was opened in response to an existing demand rather than to stimulate a new one. This makes good sense in view of the straitened economic circumstances within which the railways were by then operating, and is a significant point against the idea that railways stimulated suburban development from almost nothing everywhere. This growth testifies to the efficacy of the

horse 'bus services which were then serving the suburb, running at least hourly by 1902. The growth of the village which had begun in the latter part of the nineteenth century without any stimulus from transport thus continued, and continued to attract competition for the traffic. The first SMT motor 'bus service ran thither from Princes Street in 1906 at the low fare of 3d. Corstorphine was included in Edinburgh by the 1920 boundary extension, by which time its population was about 4,400, and in 1923 the tramway was extended from Murrayfield to serve the village. Further extensions were made as the westward growth of the suburb demanded, the final extension being to the Maybury in 1937.

It is interesting to note that the development of Corstorphine, like that of the other suburbs so far mentioned, took place solely on the basis of radial transport from the city centre. Not until the Corporation's number 1 'bus service was extended across from Stenhouse in 1936 to serve the Carrick Knowe housing scheme did the residents of Corstorphine have any choice in the route of their road transport. Finally it is worth mentioning that Corstorphine kept its railway passenger service longer than any other branch wholly within the City, which may have been due to the fact that the Corstorphine Road, serving a prosperous part of the City as well as large flows from beyond it, is subject to severe congestion delay at peak hours. A question often asked,

7. Census of Scotland 1921, County Report, Edinburgh, Table IV
   Figure for that part of Corstorphine and Cramond ward in Corstorphine Registration District.
and which is briefly discussed in section 30 below, is 'Do conditions obtaining in the area served by the Corstorphine branch railway warrant its reopening as a part of Edinburgh's transport network?'

Whilst the discussion so far has suggested that a public transport system with a service at hourly intervals or so was probably a minimum condition necessary for the development of suburban housing before 1920, there is plenty of evidence in the western suburbs that it was not a sufficient condition. The proximity of Carrick Knowe Golf Course and the steep slopes of Corstorphine Hill may be postulated as special reasons why Pinkhill (for Zoo) station on the Corstorphine branch did not result in the development of a suburb, but it remains that substantial new settlements did not develop near Barnton, Davidsons Mains or Kingsknowe stations until after the eclipse of the railway as a provider of urban passenger transport in Edinburgh. In the first two cases at least the service was frequent enough, and it could have been made so in the third. Moreover, it appears that the Barnton branch was promoted with the specific idea of promoting urban development.8

These various examples from the western suburbs of Edinburgh illustrate Kellett's argument9 that, rather than attracting dense clusters of development, where a railway

station did become the focus of a residential suburb it was
a low density one in normal circumstances in medium sized
cities. Moreover, not every railway station with an
adequate service of trains became such a suburban focus.
As will be seen in section 3C these facts are now a disadvantage
when the introduction of a public transport based solution
to Edinburgh's transport problems is considered.
LEITH, TRINITY, AND THE NORTHWARD EXPANSION OF EDINBURGH AFTER 1830 1

In 1830 the northern boundary of development of the main core of Edinburgh ran approximately from Stockbridge along the Water of Leith to Canonmills and thence up Broughton Street, although there had been some development in the Claremont Crescent area east of this line. Between the City and its port town of Leith there was a tract of undeveloped land, across which ran the three major roads between the two burghs; Easter Road, Leith Walk, and Broughton Road - Bonnington Road. The built-up area of Leith itself was more or less bounded by Fort Street on the west, Junction Street on the south, and the Links to the east.

It is observable from the graphs of population growth 2 that both Edinburgh and Leith grew fairly rapidly after 1840, yet the infilling of the space between them took place only slowly. In Leith, as in the Old Town of Edinburgh, much of the population increase seems to have been accomodated by the intensification of use in the areas of existing development, close to the docks which were a principal and expanding source of employment in the town at this period. As has already been pointed out 3, housing built specifically for

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1. See maps 6 and 18.
2. Figures 3 and 5, adjacent to section 2D.
the working classes was a rarity before the latter half of the nineteenth century in the Edinburgh area, so that it is not surprising that the earliest expansion of Leith took place westwards into the middle and upper income area of Trinity, although increased local employment in industry, fishing, and the packet steamer trade promoted working class development at Newhaven and Granton.

Trinity exhibits a more leisurely pattern of growth than the suburbs which have been considered in the preceding sections. It began early and benefitted from the opening of the railway to Granton in 1846\(^4\), including the station at Trinity itself. In combination with the attractiveness of the situation of the area on a broad plateau raised above the shore of the Forth, the ease of access to Edinburgh which this railway afforded seems to have promoted the growth of Trinity as a place of retirement for prosperous people from many different backgrounds, former colonial administrators as well as retired merchants and lawyers from the City nearby.\(^5\) It also served the entrepreneurial and professional classes of Leith itself, but not those from Edinburgh who were still working. Despite the very early public transport connection with the City, the suburb remained somewhat apart therefrom throughout the nineteenth century, and throughout this period it remained possible to find other areas, equally attractive to live in, which offered the daily traveller more convenient

\(^4\) See section 2E, page 71.

access to the city centre. Indeed, Trinity is at a distance from central Edinburgh comparable with that of South Morningside or Murrayfield, which did not develop until the 1880s and later. Even then there appears to have been no shortage of land being made available for suburban housing throughout the Edinburgh region, so that fashion could influence which areas among those available were most intensely developed. There was no shortage of land in Trinity, as the extensive feuing grounds marked on the Post Office Directory maps indicate, but there was also no shortage of land in the southern and western suburbs which were the fashionable residential areas of the late nineteenth century. Hence there was insufficient demand to sustain the level of growth which would have been possible given an immediate take-up of the feus available in the northern area, and some of the feuing grounds appear on the maps over several decades. The political rivalry between Leith and the neighbouring City may also have had an influence on the apparently low demand for houses in Trinity from Edinburgh citizens, since the suburb was in Leith Burgh.

As a result of these low but sustained development pressures, Trinity, including Wardie in the west, has been the scene of slow, piecemeal development extending over at least the last hundred and thirty years. At quite an early

6. These maps accompany editions of the Directory over the past century and more of its publication. See also appendix B.
7. See page 61 above.
stage developments in the form of large villas and small mansions spread over the whole area westward from Leith to Granton Road and southward from the Firth to Ferry Road. These limits had scarcely been overstepped by 1920, and the intervening years had seen the development of the area through the intensification of use by small scale developments on vacant land, including the grounds of some of the larger houses. Some of the later developments included tenements, but villas still occupy the larger part of the area. The eastern fringe of the area has accommodated some working class overspill from Leith proper, and along the shoreline below the edge of the plateau there is the working class area serving the harbours and their associated industry.

Whilst the opening of Trinity station was a stimulus to the early growth of the suburb, its location in the northern part of the area somewhat restricted its sphere of influence, and further public transport did not come until the 1870s. In this decade the Caledonian Railway instituted a passenger service on its Leith branch, opening stations at Granton Road and Newhaven in 1879. Earlier, in 1871, the first of the Edinburgh Tramways Acts had authorised the construction of a tramway from Frederick Street in the city centre by way of Royal Circus and Goldenacre to Trinity, continuing to the Foot of Leith Walk where it was to join the line from Bernard Street to the City. The section from Stanley Road in Trinity to the Foot of Leith Walk was opened in 1874, but, partly due to the difficulty which horses would have had in hauling heavy tramcars up the gradients from Canonmills into
the City, the western section of the route was covered by a horse 'bus service. The problem of gradients was overcome by the application of cable traction, and the tramway between Hanover Street in the City and Goldenacre on the fringe of the Trinity area began in 1888, with the Trinity horse 'bus acting as a feeder service. North of Canonmills this tramway passes through an area where little land was released for housing, and hence it could not stimulate development there. However, there was land available in the Trinity area across the Ferry Road from its terminus, but it does not appear to have been successful in promoting growth even here. The building of the Granton Circle tramway on the roads surrounding Trinity in 1909 did not materially improve the latter's public transport accessibility from Edinburgh, because of the break in traction at Pilrig which prevented through running from these Leith Corporation routes on to the Edinburgh system before 1922. Connections with central Leith from the interior of Trinity were probably worsened by the withdrawal of the horse 'bus service at about the time the tramway was extended. Although the Trinity area presents a relatively level terrain, advantageous for the builder, it is apparent that even reasonably adequate public transport, which could have been improved had prospects been better, could not overcome the obstacles to the maximum capitalisation of this advantage presented by the lack of demand already discussed.

8. See pages 68-9 above.
Meanwhile, the latter part of the nineteenth century saw the development of the area along and between Easter Road and Leith Walk as a largely lower income residential area. It is surprising that this development along so important a communications corridor did not take place earlier than it did, but again this appears to be the result of a lack of demand in the earlier period. The Hopetoun Crescent feus, for example, seem to have been available for a long time, and were never fully taken up for residential development. In Leith there were also lower income developments in the east, along the south side of the Links, and west of Leith Walk, in the area south of Junction Street and Ferry Road, but the northward expansion of Edinburgh away from Broughton Street was a slow process which has probably only now reached its limits. Large tracts of open land still remain as cemeteries and parks, and there are also substantial areas devoted to industry. From the public transport point of view some of the areas here are as remote as any in the inner areas of Edinburgh. Powderhall station on the North Leith and Granton railway routes was opened in 1895, but it never attracted enough custom to justify its reopening after closure as a war economy measure in 1917. Trams were introduced on Pilrig Street in 1905 and on Broughton Street in 1908, but the former could not provide a through service into central Edinburgh until 1922. A 'bus route along Broughton Road between the City at Randolph Crescent and Leith began in 1920 and did much to reduce the isolation of the Powderhall area from the public transport system.

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Even so, this isolation, coupled with the ability of other, more fashionable, areas to cope with demand and the pre-emption of large areas for the cemeteries and other open spaces, must surely account to a great extent for the slowness of this area to develop, despite its proximity to both Edinburgh and Leith.

Besides the lesson that development can only be activated by actual or stimulated demand, the study of this area between the two old-established settlements illustrates the lack of response which will sometimes occur to the advantages of locating in an established transport corridor. There were coaches between Edinburgh and Leith from 1610, trains from 1846, and trams from 1871, but both towns expanded in other directions before the areas between them came to be developed. If public transport were the stimulus to development that it is sometimes claimed to have been, then one would have expected the first direction of development to have been this one so well served by transport. That it was not illustrates once again the neutral role which public transport has played in determining the direction of growth in Edinburgh.

9. See section 2E above.
Portobello is a relatively young settlement which grew up along the coastal fringe of Duddingston parish from beginnings established in the last few years of the eighteenth century. There were two quite different factors in its growth; manufacturing industry based on local raw materials, and the resort function which emerged early in the nineteenth century. The poor compatibility of these two activities goes some way to explaining the direction which the growth of the area has taken. According to Grant, the earliest development of what had until then been a mire around the mouth of the Figgate Burn was the establishment of a brick works using clays discovered in the area immediately west of the Burn. Glassworks were also established in the same locality quite early, and this end of the town remains industrial at the present day. Another industry, which has subsequently disappeared, was the Joppa salt pans, at the opposite end of what was to become the resort's promenade. The earliest residential feus were granted about 1801, and from that time the town grew rapidly with populations of 2,781 in 1831 and 11,037 in 1911, after which date its history of Portobello is based.

1. See maps 6 and 19.
population and growth cannot be adequately separately identified. It achieved burghal status after the 1833 Reform Act, and was incorporated into Edinburgh for municipal purposes by an Act of 1836, although it remained virtually physically distinct from the City proper until the intervening lands of Craigentinny were built up in the 1920s and 1930s.

Public transport within the growing burgh itself was largely unnecessary because it remained relatively small and compact, but one may doubt whether its growth would have taken the form and scale it did without the provision of good transport links with Edinburgh. Portobello railway station was opened in 1846 and Joppa in 1847, but it took some time for the railway to attract custom away from the already well established road coach service, so that in 1849 the split between road and rail for the traffic was approximately 1:1. The advantage of the coaches was that they could pick up and set down passengers nearer to their journeys' ends. After 1875 the road service was provided by a tramway, with a twenty minute interval service in the 1880s, but this did not lead to an expansion of Portobello towards Edinburgh. This must almost certainly have been due in

3. Census of Scotland 1951, County Report, Edinburgh, Table 2. The 1911 figure refers to the Parliamentary Burgh. See also figure 4 adjacent to section 2D.


5. Otherwise unacknowledged transport dates continue to be taken from D.I.G. Hunter, op. cit. 1964.
part to the industrial zone, which lies hard against the core of the town on the western side, so that the main expansion of the town in the latter years of the nineteenth century was eastward into the area between the shore and promenade and the railway. Development in this direction was facilitated by the extension of the tramway from the old core through to Joppa in 1897. This development along the seafront reflects the importance of the resort function of Portobello at this time.

It has thus come about that, whereas the fusion of Edinburgh and Leith arose from the development of each of them towards the other, the fusion of the built-up areas of Edinburgh and Portobello in the years after the first World War resulted almost solely from the eastward expansion of Edinburgh. The possibilities for the City's expansion in this direction have always been severely curtailed by the presence of Arthurs Seat and its surrounding Royal Park of Holyrood. This coincides with a lack of demand in the past for development in this direction to explain why so little had happened here before 1920. There were, for example, plans to lay out the lands north of the Calton Hill as a fashionable residential development akin to the contemporary exercises at the West End, but the lands were so slow to feu that only the very southernmost part was built as intended. The building of the Regent Bridge and the Regent Road in the early nineteenth century improved the approach to the New Town from the east but it did not open up building land in quantity close enough to the City to encourage development.
here in the face of competition from the west. The eastern approach to the Old Town was also discouraging, being through the residential and industrial area of the Canongate where the closes were as noisome as any, and where such developments as the gas works in New Street, opened in 1818, were adding to the unpleasantness. The Portobello tramway did not give any noticeable impetus to the slow spread of mainly working class housing which had begun along the fringes of Holyrood Park and the road to Portobello, but it seems probable that it was an enabling factor in the development of the old hamlet of Jocks Lodge into a marked node of population from the decade of its opening in 1875 onwards. In suggesting this it must also be remembered that there were in this area at this time two possible generators of development in the form of Piershill Barracks and the St. Margarets locomotive depot of the North British Railway, although these establishments, in conjunction with the practice of using City sewage to irrigate the nearby meadows of Craigentinny, would have made the area somewhat noisome and unpleasant to live in. Even so, they may help to explain why there is a somewhat larger knot of development of pre-1920 date at this spot than between it and the City. It is also interesting to note that the village of Restalrig, close by Jocks Lodge but less easily accessible, could be described by Grant, writing in 1882 as 'secluded' and almost forgotten by many folk.  

and Portobello, namely Inchview Terrace and Moira Terrace, first appear in the Post Office Directory in the first decade of the present century, but there was little other development beyond Jocks Lodge by 1920. This is not so surprising when it is remembered that the contemporary westward development of the City was only taking place at similar distances from the centre. What is more interesting is the lack of development in the area between this narrow finger of building and the development along Easter Road, the area which came after the first World War to be developed as the first large-scale Corporation housing venture. In part this was the area of the sewage irrigated meadows, but one may also assume that the pressure for development on the east side of Edinburgh was so low that the higher areas around these meadows which were adequately served by transport could cope with the demand. Thus there was no incentive to bring this intervening inaccessible area, with its valuable hay production into residential use during the nineteenth century.

Before leaving this area of the City it may be worth noting the small part that the railway as a form of passenger transport (as opposed to an employer of labour) played in the development of the area. There was a station at Jocks Lodge when the main line from Waverley to the east was opened in 1846, but it did not attract custom and was closed in 1848. The next station to be opened was at Abbeyhill on the Leith and Granton line diversion opened in 1868. Piershill

followed in the last years of the century. Abbeyhill served an area which was then developing, but its effect on this development is questionable, for the same reasons as for the Dalry and Gorgie tramway, 8 whilst Piershill gave the Jocks Lodge area direct services to the city centre and to Leith, although after the former, more important route had been served by more accessible trams, so that its effect on development was probably also small.

The southern fringe of Holyrood Park is quite some distance from the centre of Edinburgh, and the distance to developable land is increased by the presence of several further large areas of open space which remain to the present day, such as Prestonfield Golf Course. Thus in this area eastward growth did not begin effectively until after the first World War. However, there are, and were, several earlier settlements in this area. Easter Duddingston, a farming settlement on Milton Road which once contained five hundred people, 9 has effectively disappeared, but others remain. The mining village of New Craighall is now within the City limits, but remains a distinct settlement to serve which 'buses have to travel through a stretch of unbuilt country where there is too much danger of mining subsidence for further residential development at present. Another mining settlement, Jubilee Cottages on Niddrie Road, has not remained isolated but is now surrounded by suburbs, yet

8. See page 84 above.
here one cannot say, as one can of some of the western villages which became incorporated into the City, that the settlement had developed as an outpost of the City before that incorporation. There was neither demand nor transport here to attract the speculative builder, and 'miners' rows' would not attract the person pioneering a new settlement by having a house built to order.

Duddingston village is one of those around Edinburgh which have rural roots, but by the late nineteenth century it was attracting other types of people, such as brewers, although admittedly not on a large scale. The presence of the brewer may have been connected with the small brewery cluster which grew up around the railway within a comfortable walking distance to the south of the old village. There is a certain amount of working class housing here which is contemporary with the breweries to all appearances, but it does not seem to be an adequate supply to meet all the needs of the workforce which one would imagine the establishments there would need. One might speculate that the deficiency was made up by people who arrived by the South Side and Suburban line trains at Duddingston and Craigmillar station, but this is probably unrealistic. The railway would, however, have been all important in supplying the breweries and maltings with fuel and raw materials, and from the layout of the buildings it seems that at least some of the growth was

1. The occupations of some residents were given in the 'Post Office Directory' for many years, and this is the source here.
subsequent to the opening of the South Side line, despite the fact that the Edinburgh and Dalkeith line out of St. Leonards had passed the site since 1830. It would seem, however, that Duddingston and Craigmillar station is another of those in the Edinburgh area which disprove the contention that access to a suburban railway passenger service was sufficient condition for the founding of a residential suburb.

Under modern conditions the fact that the eastern side of Edinburgh is not the side nearest to the mainstream of Scottish economic and social activity counts against its development, and it would not be as favourable a location for a new office block, or a block of prestige flats, as would the western side of town. However, it is open to question as to whether this factor of location in respect to 'Effective Scotland' was as important in the past, and it seems probable that, insofar as the housing is designed for local workers, it would have been other factors, including those mentioned in this section, which led to the pattern of development which did emerge on this side of town.
Having traced some main threads in the development of Edinburgh, Leith, Portobello and other of the City's suburbs from 1830 down to the period immediately prior to the first World War, and seen the relationship between this development and public transport, it is now appropriate to review the City as it stood immediately after that war.

The city centre had more or less stabilised itself in its present form after several nineteenth century changes, affecting principally the Old Town and the valley to its north, where the Nor'Loch had been replaced by Waverley station. Whilst the legal and administrative functions of the City remained in the Old Town, the bulk of the commercial and retailing activity had moved into the New Town, partly on account of the focussing of the tramway and railway systems on Princes Street, giving it incomparably better accessibility than the High Street.

To the north of the New Town, Edinburgh and Leith were joined by a built-up corridor along Leith Walk and Easter Road, although to the west of this corridor a significant amount of infill remained to be undertaken. Trinity, with Wardie, formed a well developed suburb, although its development was still far from complete. It was complemented on the east by a considerable suburb on the south side of

2. See map 20.
Leith Links which served a somewhat lower income group. Further east still was Portobello, still a distinct settlement although joined to the Edinburgh outpost of Jocks Lodge by a ribbon of development along the tramway, and administratively a part of the City since 1896. The first streets on the Craigentinny development, which was to close the gap in the built-up area between the two towns in the following decades, were already developed. Portobello itself was still growing rapidly, and had expanded eastward from its original core to cover all the land between the seafront and the main railway line as far as Joppa. In addition, there were straggling beginnings of growth to the south of the railway.

South of the Old Town, development stretched as far as Blackford Hill, and had begun to spill round the ends of the area of unsuitable terrain for building which this and the Braid Hills presented, although there had been no extension of the tram routes serving these areas of Liberton and South Morningside since 1897. Westwards, at Craiglockhart and along the Gorgie and Slateford Roads, development had filled the whole area east of the South Side and Suburban Railway, and was beginning to spread west of it. The New Markets at Slateford were open, with rail access, and the first streets of the first suburban public housing scheme were being laid out nearby. Murrayfield was well established and development of Saughtonhall, the next suburb westwards, had begun, with its public transport supplied by the SMT services to Corstorphine and beyond. Outside the continuously built-up area of the
City several independent suburbs were well established, on the basis of railway and motor 'bus services rather than the tramways which had facilitated the development of the inner suburbs. The largest of these suburbs were Colinton, Corstorphine, and Blackhall, but there were smaller nuclei at Juniper Green, Davidsions Mains, Barnton and Cramond.

Many of these suburbs were brought within the City boundary by the Edinburgh Boundaries and Tramways Act 1920, which also brought about the final amalgamation of Leith with the City, despite opposition from the smaller burgh. This Act helps to mark out this immediate post-war period as one of significant change in the development of Edinburgh, and it also contained powers to convert the Edinburgh trams from cable to electric traction, reuniting the systems in the City and in Leith, thus strengthening the position of the trams in the public transport system of Edinburgh. It was at this period too that the Corporation began to operate motor 'bus services within the City to complement the trams on routes for which the latter were unsuited. Although SMT had been operating 'buses in the area since 1906, the entry of the Corporation into the field was of considerable importance later in the development of the City, as will be shown in the next section of this chapter. By this time the railways, never of great importance in Edinburgh, were past their zenith, although they were to continue to play a role in the internal movement of passengers in the City for over thirty years more.

However, perhaps the most important change in the
direction of development of the City at this time resulted from the Housing, Town Planning, etc. (Scotland) Act 1919 which began the large-scale development of public housing schemes, as will now be discussed in the next section.
Sections 2F to 2I above show how patterns of development before the first World War differed considerably from one area of Edinburgh to another, according to fashions and local conditions, but developments after 1920 show a considerably greater degree of similarity between the various parts of the City. This reflects the advent on the housing development scene of entrepreneurs working on a much larger scale than previously, including most importantly the City Corporation itself. A second feature of this period, already discussed in section 2D, has been the fact that the considerable areal expansion accomplished by the building programme has not been accompanied by a commensurate rise in the total population, which according to census data has never exceeded the 1921 population of just over 420,000 by more than 50,000.

Purpose built working class housing had been provided in a small way in the congested parts of Edinburgh by philanthropic bodies and others since the 1850s, but despite the powers available to it under the Housing of the Working Classes Act 1890, it was not until after the Great War that the Corporation was active in the provision of housing for the poorer classes. The incentive to do so came when the Housing, Town Planning, etc. (Scotland) Act 1919 put into legislative form the great promise of 'Homes for Heroes'.

3. See maps 21 to 23.
which had been a slogan of the recent General Election. Edinburgh soon responded with a scheme at Chesser Avenue in Gorgie, and other schemes followed. Further legislation in 1923 and 1924 provided for Government subsidies to the local housing programme, and was followed by the inauguration of very large schemes in Edinburgh at Locheend (Craigentinny), Granton, Niddrie, Stenhouse and Saughton. By May 1939 the Corporation had, since the first World War, erected 15,000 houses out of a total of 42,000 approved by the Dean of Guild Court in that period, and had given financial assistance to over 12,000 others, including 4,000 built for letting (with a further 1,100 arranged for) at such sites as Carrick Knowe, Pilton, Colinton Mains and Sighthill. Parallel to this was a slum clearance programme which had affected almost 7,000 houses and 22,000 people. Some of these schemes had also involved reconstruction of existing houses and new construction on cleared sites, but only about 1,100 new houses had been provided in the central area of Edinburgh, with a few hundred others in the corresponding part of Leith. The many people displaced were rehoused in the new suburban schemes, notably Locheend for the Leith clearances, and the Prestonfield and Niddrie areas for those displaced by the very large St. Leonards scheme in south-central Edinburgh. 4

The densities at which the houses in these new schemes were built were quite low, 5 whilst opinion of the period, as

4. Most of this paragraph is based on two articles in the 'Weekly Scotsman', 13th and 20th May 1939.
reflected in the press, generally shows the influence of the 'Garden City' concept at that time, assuming that the light and air of the new surroundings will compensate for the difficulties involved in reaching them. Contemporary press cuttings also show that the slum problem was far from being overcome. For example, one article in the Edinburgh 'Evening News' refers to the difficulties which arise when poor people are asked to live at a considerable distance from their work, quoting cases where families felt that they were faced with the alternatives of either living in a slum and having a job or moving out to better accommodation and becoming unemployed. The full extent of this problem, which embraced both the extra costs involved and the question of bus service times, may not have been clear to the administrators, designers and politicians behind these schemes. Certainly the bus network was repeatedly extended to serve the new developments, and the trams were reaching their cheapest ever fares, but although seventy per cent of the tram passengers could travel for 1d from November 1931, it was the more expensive buses which provided the main service to the new council estates. The maximum bus fare of 5d. seems quite cheap by today's standards, but with the five and a half day working week

5. The 'Scotsman', 25th April 1934, quotes twelve houses per acre in connection with the Middrie scheme.

6. 'Our Uninhabitable Homes', 14th January 1937. Like many of the press extracts quoted this may be found in the Housing Press Cuttings in the Edinburgh City Library.
then prevalent, this would give rise to work journey costs of five shillings per worker per week. Given the wage levels of the period this would be a lot of extra money to find when one had been used to walking to work, since the move would not be accompanied by an increase in income. Even a 3d. fare would have caused hardship for a labourer moved away from his work by a slum clearance scheme.

To compound these difficulties over cost, the public transport provision on some of these schemes was laggardly in appearing, and it was not always as convenient as it might have been. These suggestions have been made specifically with reference to the large Pilton schemes, where railway enterprise in opening East Pilton Halt in December 1934 proved popular, and continued to be so even after a ‘bus service from the city centre was begun the following April, partly because the railway also served Leith directly, which the ‘buses did not. Because it was relatively easy to extend a ‘bus route into a new development, and because through controlling transport services as well as the housing programme they could expect to coordinate the development of both, the Corporation could afford to ignore the existing lines of public transport in deciding where to locate their schemes, and could make the choice on the basis of potential rather than existing accessibility. In this respect, as will be mentioned, they differed from the private developers, but if the coordination between the Corporation’s

departments was poor, their freedom of choice could lead to difficulties for their tenants, such as apparently occurred at East Pilton.

After the second World War there is evidence of new patterns of thought in the Corporation housing department, with an emphasis on higher densities rather than allowing the developments to sprawl away to distances from the city centre which were already thought unacceptable. Nevertheless, there was little opportunity to implement this for a few years because of the need to provide a lot of houses quickly, a procedure which included the use of about 4,000 'prefabs' put up wherever possible, many on sites like Calder Crescent at Sighthill which are further from the city centre than the most remote of the pre-war schemes as executed. These 'prefab' sites have mostly been redeveloped with permanent housing, but they represent the 'high water mark' in the spread of council housing outward from the centre of Edinburgh. The site at Sighthill was in an area which before 1939 had been adopted as the site of a very large suburban development which would have included a reserved track for trams along a widened and dual-carriagewayed Calder Road.\(^8\) This scheme had been begun before the war, but no start had been made on the Calder Road tramway extension and road widening. New ideas, and the demise of the tramways after the war have meant that the scheme has been completed in a different form.

Returning to the new ideas on density, these are admirably

illustrated by a report of a Council discussion of the residential density policy for the even yet undeveloped land in Queensferry Road opposite Daniel Stewart's College. The proposed density was 75 persons per acre, which was said by its proponents to be necessary in order to allow as many people as possible to live near the city centre, thus reducing the spread of the town, which contemporary correspondence in the press suggests was a touchy subject at this time.

Existing densities in the area were quoted as 26.9 persons per acre for the bungalow development on the north of the site, and 122 persons per acre for the adjacent development of fairly recent private flats on the opposite side of the Orchard Brae. This is a prime site with good access and surrounded by good class private development, and it is obvious from the discussion that the chief objection to the proposed density was that it would have to be council flats, since the upper limit considered acceptable for private development was 60 persons per acre. The result of the discussion was a reduction in the planned density of this site from 75 to 65 persons per acre, and of another site at Inverleith Nursery from 75 to 30 persons per acre, showing that, although the need for higher densities was accepted, it was not politically possible to require these densities.

1. These letters concern the purchase for council housing of Gracemount Farm, Liberton, and so also reflect the usual animosity of local owner-occupiers to such development.
Map 21

Key to numerals, etc.

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<td>3.</td>
<td>East Pilton and Granton</td>
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<td>Longstone*</td>
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<td>Niddrie Marischal and Greendykes</td>
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<td>Gilmerton Dykes</td>
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<td>Brunstane</td>
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<td>30.</td>
<td>Saughtonhall**</td>
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* A mixed area containing private as well as public housing.
** An area of mainly private housing with, apparently, a small public scheme included close to the railway.

The map shows schemes built for rental by private builders which received public aid as well as conventional public housing, but does not distinguish between the two. See text, page 112.
from every possible development. However, it was not only in the more central areas that this increase of density was proposed but also in the outer estates, so that the 1953 proposals for Muirhouse involved multi-storey construction for a density of 140 persons per acre, and it is noticeable how much high density multi-storey construction is to be found in the suburban council estates of the age of Muirhouse and later, including the latest big scheme at Wester Hailes. This is due partly to the land shortage created by the Green Belt policy which has been used to control the spread of the City since 1947, as well as to the desire to keep the council houses within reasonable distances of the work areas.

Meanwhile, in the private housing market, improved methods of financing house purchase, and improvements in real incomes for many people, have brought owner-occupation within the reach of a wider market. In the 1920s and 1930s the typical form of house built in Edinburgh for this market was the bungalow with its own garden and, in some of the later and more expensive developments, a garage on the site. Many of these bungalows were built by large companies operating several sites in different parts of the City at one time. For example, James Miller advertised in the 'Scotsman' of 12th January 1935 that the firm was building at Comiston, Slateford, Bellevue, Polwarth, Northfield, Craiglockhart, Seafield, Craigentinny and ten other sites. It will be noticed that this list includes, at Bellevue and Polwarth, a certain amount of central area infill besides most of the popular

suburban sites. However, because Miller was building mostly cheaper types of houses, costing around £500 in a market whose top prices, even for standard houses, were well over £1,000, it does not include the more fashionable and expensive areas of development on the western fringes of the City, as at Barnton and Corstorphine. There was generally a steady demand for houses at this period, and it would seem that almost any site free from nuisance would sell, providing that it was within reach of public transport. Because private developers exercised no direct control over this transport they could not, as the Corporation could, choose sites solely on the basis of potential accessibility. By the early 1920s there were SMT services on all the major radial roads beyond the limits of the Corporation 'buses, and tramways, which no doubt helped to concentrate private development along such routes. However, the most advantageous sites were undoubtedly those near to the tramway, and the several tramway extensions to Colinton, Corstorphine, Liberton and Fairmilehead also extended the availability of such sites, promoting the further diffusion of residential areas. For example, there is a remark in an article in the 'Weekly Scotsman' to the effect that Liberton village was considerably enlarged following the extension of the tramway up Liberton Brae in 1924. In an advertisement for the Corstorphine Bank Estate the words 'Car Terminus' are given prominence, and

in an advertisement for new bungalows at Fairmilehead the
impending extension of the Braids tram route past the site is
referred to. The standard of service which the trams offered
at this time may be judged from the fact that the following
extract from 'The Scotsman' was considered newsworthy.

'Edinburgh Tramway Breakdown: A breakdown to one of the
Portobello - Slateford trams caused a hold-up in the Post
Office - Joppa service on Saturday. The disabled car was
pushed up to Piershill terminus where after a few minutes
delay it was taken in tow by another car. The hold-up was
felt most acutely at Waterloo Place where people had to
wait from about 10 to 15 minutes for a car.'

Despite so good a tram service, the private motor car
was, by the mid-1930s, beginning to have an effect on the
private housing market, liberating development from the need
to locate within easy reach of private transport, although
the full effects of this liberation have still to be felt in
Edinburgh. Even in the 1930s some houses in the Torphin and
Bonaly areas in the south west of the City were more than
five minutes uphill walk from the tram terminus and shops in
Colinton village. As was suggested in section 1E above such
distances are more than most people will willingly walk to
reach transport, yet these areas were able to develop twenty

5. 'The Scotsman', 1st, March 1935.
Place is adjacent to the GPO.
7. See page 38 including footnote.
years before the 'bus replacing the Colinton tram was extended to them in 1956.

Since the last war, the application of a strict Green Belt policy around Edinburgh has led to an increasing scarcity of building land within the City, and there has been a tendency to build houses of types more economical of land than the detached bungalow of the 1920s and 1930s. In addition to these pressures, with the liberating possibilities of the private car to allow it, have led to the development of some of the spaces between the linear developments which the pattern of development in the 1930s led to. Most of this filling out of the urban pattern has been done by council developments, which have occupied a substantial majority of the newly developed housing land in the City since 1945, but it has also been found in the main area of private development between and around Corstorphine, Barnton, and Davidsons Mains. There have been many other private housing schemes throughout the City, some between the outer edge of existing development and the inner edge of the Green Belt, and others infilling gaps in the existing built-up areas. However, these schemes have been relatively, if not absolutely, small in scale, and the recent trend has been for large private housing schemes serving the Edinburgh market to be located beyond the City boundary. At Currie these developments have been contiguous to the City's existing built-up area, but others have overstepped the Green Belt and are found in such places as Musselburgh, Penicuik and South Queensferry. Such estates have been attached to existing small towns which have well
established shopping facilities and a frequent 'bus service into Edinburgh so that they have been quite popular with even one-car families from the City. There has even been some success with developments in existing towns in Fife, but the 'green field' residential development at Dalgety Bay, although having good enough accessibility by road to Edinburgh for commuting purposes, is served by only one 'bus an hour and that does not give a through service to Edinburgh. This has made for isolation among the housewives who live there, and the estate has been successful only insofar as its potential residents have been able to overcome the problems that this poor accessibility gives rise to. For a family whose income derives from an urban area, the threshold in their economic advance beyond which they can contemplate choosing a house without reference to the availability of public transport is almost certainly the ability to run two cars, and so few families in the Edinburgh area are likely to reach this standard in the foreseeable future that public transport must continue to have a constraining influence on urban development.
Section 2L
THE PRESENT SITUATION. 8

In this chapter the development of Edinburgh from 1830 to the present date has been discussed, and an attempt has been made to assess the influence of public transport and other movement possibilities on this growth. The most important conclusion to be drawn from this discussion is that the availability of transport is a necessary but not a sufficient condition for suburban growth. In the period which has been discussed there have been two major changes in transport availability, and these have had a liberating effect on development, affecting first prosperous entrepreneurs and professionals and later people increasingly further down the income scale. The first of these two changes was the advent of widespread public transport in the nineteenth century, which allowed development to take place on a large scale beyond a walking distance from the city centre. Because the population of the City was increasing, and could, by the end of the century at least, have only been accommodated in a city based on pedestrian movement alone at densities higher than the more prosperous families would tolerate given an alternative, this potential for expansion was taken up and the diffusion of the residential areas of the City was begun. This dispersal, however, did not extend to the activities on which much of the City's life depended, and

8. See maps 23 and 24.
although the centre of such activity gradually shifted from the Old Town to the New Town, partly because the latter was better served by public transport, it remained concentrated in the city centre. Hence there arose a pattern of increasing movement between the suburbs and the centre, especially during the peak travel hours when people were going to or from work.

The second change in transport availability was the advent of motor vehicles, especially after 1920. The motor omnibus made a new public transport service easier to provide initially than with the technology of trams and trains, and cheaper to operate than with the horse 'bus. These factors made it far easier for developers, with the cooperation of the transport operators, to select sites for development on the basis of potential rather than actual accessibility.

The private motor car in mass production offered the possibility of liberating development from the necessity to consider public transport altogether, although, as was suggested on page 121 above, it may not be possible to fully realise this liberation until a family has sufficient economic power to command the use of at least two vehicles. Together, the motor 'bus and the private car have facilitated the very great areal expansion of Edinburgh which has taken place since 1920, and which would undoubtedly have taken on an even less tight-knit form than it has had it not been subjected to the constraints of the Green Belt and other statutory planning policies since 1947.

However, the private car has been used for personal
liberation from dependence on public transport even where that public transport is available, and this has resulted in its use for movements between the residential suburbs and the concentration of employment which remains in the central area. This use, involving ever increasing numbers of vehicles, has, in its turn, resulted in the overloading of the road network in this area, with a resultant problem of serious congestion delays. In the next chapter the solution of this problem is discussed, and it will become apparent that the pattern of growth which has been found in the City's suburbs makes such a solution using an ideal form of public transport as outlined in section 1E above difficult. In the suburbs housing densities tend to vary inversely with economic power, so that housing for prosperous people tends to be at low densities, and working class housing, which is virtually synonymous with local authority housing, forms the chief pockets of higher densities, although the current land shortage in the City is tending to raise the density of all types of new suburban development. Because in Edinburgh the tram and the train were principally associated with middle class housing developments, their routes tend to correlate with low residential densities in the suburbs, to the extent shown by map 24. The railways in particular were of most significance in affecting the City's growth where they facilitated the development of low density, high income suburbs such as Colinton.

Because they served high income areas the railways were in most cases vulnerable to competition from the motor car
for their base-load traffic, and therefore rail travel does not play an important part in the City's internal circulation at the present day. Most of the railways now have no passenger service. In many cases the tracks have been removed and in some cases, such as between Davidsons Mains and Barnton, even the right of way has been lost. However, there are still several miles of unused right of way available should a solution to congestion problems require them. 'Buses have completely replaced the trams, but, partly because Edinburgh has a lower car ownership rate than many modern cities, and because staff recruitment is facilitated by a lack of competition from highly paid industrial work, the City now has an excellent network of bus services, providing as good a public transport service as can be expected given the problem of congestion delay in the city centre. Despite this the shift to private transport apparently continues, and unless something is done to correct it the problem of congestion may be expected to get worse.

As has been shown, the area within the existing City limits has already begun to lose rather than to gain population, and figure 1 has shown that there is a substantial movement into the City from the surrounding area for work. The prediction of 'Alternatives for Edinburgh' is that

1. Adjacent to section 2B
2. Op. cit., table 4. This report will be discussed more fully in the next chapter.
despite this decrease in population there will be a slight increase in the total employment in the City. Since it is expected that this increase will arise from an increase in the types of service employment concentrated in the central area which will more than offset the expected loss of jobs in manufacturing, there is every probability that this will compound any worsening of the congestion of the central area at peak travel times due to rising car ownership and usage. The increasing numbers of people living in the satellite towns beyond the Green Belt, such as Penicuik, a town which increased in population from 6,000 to over 10,000 in the inter-censal decade, 1961 to 1971, may even further aggravate this because there is a greater advantage to be gained from using private rather than public transport for the longer distance journeys to and from these places.

However, this will probably not be true of public sector housing overspill to, in particular, Livingston New Town which has its own industrial base to employ many of the incoming workers.

Within the City the largest areas of undeveloped land still available for housing are on the periphery of the existing built-up area. However, because such land is in short supply, the tendency which may currently be observed to undertake small infill developments may be expected to continue, although not on a scale sufficient to offset totally the decline in the intensity of residential land use

which has been in progress for many years.

Finally, there are signs that the decentralisation of the commercial and administrative functions of the city centre has begun on a significant scale in recent years, although how far developments such as the Lloyds and Scottish offices in Orchard Brae, the MCR building at Roseburn, or the Post Office Telephones administrative building currently being built at Gorgie represent other than an accommodation of the excess increase in central area space requirements is a matter for consideration. There are limits to which the decentralisation process can go, as will be shown in section 3D below, but one factor which will count in favour of such a move for routine workers is the problem of transport congestion in the city centre. Such then is the Edinburgh whose transport planning problems are now to be discussed.
Against the background of the present situation as set out in section 2L, the planning and transport consultants to the City of Edinburgh, Colin Buchanan and Partners, and Freeman, Fox, Wilbur Smith and Associates, have recently (October 1971) produced a second interim report on their work, entitled 'Alternatives for Edinburgh'. This discusses their investigation of a number of different systems which could provide for the predicted transport needs of the City in 1991, and outlines their preferred solution as a basis for discussion with the Corporation and the public before they proceeded to the final design. Their terms of reference required them to undertake their studies against the fixed background of the City's existing land use plan, but they themselves hint that a solution to their problems would be easier to find given certain modifications to the land use pattern. It is the purpose of this chapter to examine the preferred solution of 'Alternatives for Edinburgh', and other possible solutions, including those which would give an enhanced role to public transport, an idea actively canvassed by some groups in the City at present, and those which achieve their end by adjustments to the pattern and intensity of land uses within the City to accommodate the unrestricted use of private transport. The background for this examination
will be the general and theoretical discussions of chapter 1 and the historical studies of chapter 2, and the intention is to examine what light these studies can shed on the present planning problems of the City.

In discussing the various possibilities it becomes apparent that many of them require the use of some form of restraint, such as parking rationing. The use of such restraints, which prevent people from doing what they would otherwise wish to do, has important political implications which cannot be ignored in preparing a plan of any sort. People in general probably prefer to do something which seems to them to result from their own decision rather than do a similar thing which is forced on them by restraints imposed by other people. Hence, in the sense that it will be more acceptable than a plan involving restraint, a plan achieving the same end by leading people to choose what seems to be the correct course in the light of an analysis of the problems involved will be a better plan. For example, if it seems desirable that people should transfer from private to public transport for a certain journey, a plan which achieved this by an active promotion of the competitive advantage of public transport would be a better plan than one which achieved the same end by charging fifty pence a day for parking or by banning private transport from a particular area altogether. This attitude may be open to contention, but it seems reasonable enough to the present author and has been in his mind in composing what follows.
THE PREFERRED SOLUTION OF 'ALTERNATIVES FOR EDINBURGH'.

On the basis of the results of their tests of various possible types of solution to the expected transport problems of Edinburgh over the next twenty years, the Consultants have, in 'Alternatives for Edinburgh', put forward their own preferred solution as a basis for discussion. This would involve a certain amount of new road construction, but mainly in the outer areas of the City as opposed to the central area.

To improve the competitive position of public transport, the construction of a few miles of busway to improve access to the city centre from the east and from the west is suggested, with a certain measure of 'bus priority routes on the other approaches. Because the level of new road construction in the central area proposed would be low so as to minimise its impact on the environment of the Old and New Towns, which is considered by many influential people to be worthy of conservation, and is, as was mentioned on page 54 above, important to the City's tourist industry, the road system as proposed could not accommodate the predicted unrestrained peak-hour traffic flows. These would therefore have to be restrained, and the suggested method is through parking control.

At least a part of the general problem which Edinburgh's transport system is facing, and to which the consultants are seeking a solution, is the congestion of central area access. The origins of this problem were described in the preceding.
chapters, and it is with this aspect in particular that the present study will be concerned. However, there is another aspect to the problem in Edinburgh as a whole, as the consultants see it, which any alternative proposals cannot ignore, and that is the forecast that by 1991 there will be a substantially increased number of inter-suburban trips to be accommodated. In some measure this bears on the central area problem in that if these trips are not effectively bypassed around the centre they will contribute to the excess trips in this area, intensifying the problem there. An inter-suburban trip passing through the centre is equivalent to two trips between suburb and centre, although at the periods of peak congestion one of these trips will be against the prevalent and congested direction of flow. However, it will be helpful to recognise two separate problems in central area access and inter-suburban movement. Hence some components of the consultants' recommended plan, such as their proposed intermediate circular road circling the core at a radius of about two miles on its northern, western and southern sides, will need a substitute which fulfills the same function if they are rejected in an alternative plan.

Whilst the consultants' preferred scheme, and the tested scheme on which it is largely based, need parking restraint because of the inability of the proposed road network to cope with the expected level of unrestricted flows at peak hours, this would not be the case with other of the schemes tested involving a higher level of investment in roads. Even a medium level of investment could apparently provide
enough roadspace to accommodate all the expected traffic
flows, but finding enough space to accommodate the resultant
demand for parking would present serious problems given the
importance of environmental considerations in central
Edinburgh. In other words, the report suggests that, within
the limits of the study, measures to constrain and regulate
the demand for parking in the city centre will be inevitable,
whatever the capacity of the circulation system provided for
private transport.

There are two main tools available to achieve the necessary
level of restraint. Firstly, the supply of parking may be
kept below the demand and within the limits that land
availability or any other relevant consideration dictate.
This shortage will result in some contraction of demand as
some potential parkers decide that their expectations of
finding a space are too low to make it worth their taking
their vehicle into the area of shortage. However, there
may still be more people looking for space than there are
places available, so that there would have to be strict
control of unauthorised parking, and also measures to ensure
that everybody whom it is desirable from an overall view
should find a space is able to do so. For example,
commuters must be prevented from monopolising spaces which
ought to be reserved for shoppers.

In addition to the regulation of space availability,
there is the second tool of pricing, which can act both as a
deterrent and as a device for distributing the available
spaces between the different types of users in accordance
with local economic and transportation policy. Parking costs and charges are discussed more fully in appendix A, from which it will be seen that there are several difficulties in the way of determining policy with regard to parking charges, which make this a tool to be used with circumspection on the basis of careful research and a clear understanding of what it is hoped to achieve. It may well be that the mere restriction of supply would be a more useful tool in persuading people not to use their cars for work journeys into central Edinburgh and to travel by public transport instead, especially since it has been shown that price may be of relatively small importance in determining the relative competitive advantages of public and private transport.  

Having laid so much emphasis on the part to be played by the restraint of private vehicles in the solution of Edinburgh’s transport problems as they relate to the central area, it is pertinent to consider also the role which 'Alternatives for Edinburgh' gives to public transport. Although its preferred solution does include the use of such measures as 'bus priority routes and busways to achieve what it calls an effective system of public transport, the present author does not feel that the tone of the report suggests that a very great importance was given to using the public transport system as a positive tool in the management of any future integrated transport system for the City. For example, paragraph 149 of the report, introducing the chapter on

4. See section 1D above, particularly pages 30-1.
public transport, which follows a description of the evolution of the road networks tested, reads as follows:

'It is evident that each of the concepts described in the previous chapter will entail a somewhat differing role for public transport. It is equally clear, however, that each of them must provide for an effective public transport service. There are three main reasons for this. First, even with a much higher car ownership level than at present, there will remain an appreciable number of persons who do not own or use cars, and who will have to rely on public transport. Secondly, the existence of an efficient and reliable system of public transport could lead to some reduction in numbers of people who chose to travel by car. Thirdly, such a system could be an important means of securing a high level of accessibility to the Central Area, thus helping to maintain its commercial viability.'

This reads, as does the rest of the report, as though the possibilities of active promotion of public transport, maximising its competitive advantage in the ways suggested by sections 1D and 1E above, did not enter the debate. Consider also section 331 of the consultants' report, discussing the test procedure used, which includes the following:

'Where flows were seen to exceed capacities, careful thought was given to whether, in practice, drivers would instead use nearby alternative routes on which there was spare capacity. Where such a transfer was judged not to be feasible, it was assumed that a reduction in the
number of trips by car in the system would be necessary, and that this reduction would be achieved by means of parking controls.'

The point is that one may conceive of a solution wherein the reduction of private trips, where this seemed necessary, would be achieved by the promotion of public transport. Whether this is in fact possible in Edinburgh remains for the discussion which here follows to indicate, but because there is an influential body of opinion in the City which favours a more important role for public transport, the matter cannot be ignored. In the next section the possibilities for giving public transport this more positive role are discussed.
As was suggested at the end of the preceding section, there is now a significant body of opinion in Edinburgh which favours the promotion of public transport as a means of solving the potential and existing transport problems which face the City. It was also suggested that these problems may be divided into two groups; those concerned with an excess of demand for peak hour travel between the suburbs and the city centre over the capacity of the system to accommodate such flows, and those concerned with accommodating an expected substantial increase in the demand for inter-suburban travel. It is now time to bring together the discussion in section 1E above of what constitutes the ideal situation and form of urban public transport, and the description of the relationship which existed between the growth of the City and its public transport network given in chapter 2 with a view to examining the feasibility of promoting public transport in Edinburgh as a solution to either or both aspects of its expected transport problems.

Consider first the problem of providing for an expected increase in inter-suburban traffic flows which it is forecast will be of considerable magnitude. In discussing such flows in the ideal public transport situation (pages 41-3 above) it was explained why they were not amenable to

5. 'Alternatives for Edinburgh', see figure 14 and paragraph 115.
accomodation by a mass carrier mode, and it was suggested that the conventional 'bus, acting as a supplement to the private car, would be the best means of providing the necessary basic services. The arguments given there, and the implication that the demand for such trips can be catered for best by accomodating the private car, also hold good in a non-ideal public transport situation. It is likely that the degree of restraint which would be necessary to force any significant number of these trips to use public transport rather than private cars would be politically unacceptable, and unjustified by any incapacity in the road system of Edinburgh, even as it exists at present. Therefore, if there is to be an expansion in the level of inter-suburban trip making, then either the existing roads will become more crowded, resulting in some general loss of amenity and the intensification of problems at local congestion spots such as Morningside Station, or the new flows will be accomodated on new roads, which according to 'Alternatives for Edinburgh' will probably cause only local amenity problems. If necessary, some inter-suburban trips could perhaps be transferred to public transport, but there is limited scope for this except perhaps on certain radial routes.

However, the more intractable problem in the case of Edinburgh is that of peak hour and, to a lesser extent, general congestion in, and on the approaches to, the central area. It has been shown that the ideal situation in which public transport can attract a substantial part of the traffic
into and out of this area is one in which the suburban population is concentrated along radial axes. However, as will be clear from map 25, as well as from chapter 2, this ideal situation is not the general case in Edinburgh. There are some local concentrations of people, such as at Niddrie and at Sighthill, but in large areas, such as around Barnton, the population is very scattered. The higher density suburbs tend to be associated with the lower incomes, and some of the mainly working class council housing schemes have the highest densities of population in suburban Edinburgh. The converse is also true, namely that the lowest suburban densities are associated with the most fashionable areas, which house the people with the highest incomes. This is true even of the older suburbs which were dependent in great measure on public transport. The result is that the higher levels of car ownership, which may reasonably be assumed to occur in the areas of higher incomes, are found in the lower density areas of the suburbs. Thus the high density and low income areas of the suburbs will probably have a relatively and absolutely low proportion of car owning households, and so, because public transport needs a high density of population to support an attractive

6. See section 1E above.

7. In the more central parts of the City where there seems to be a concentration of small families, many of only one or two persons, a high figure for car ownership may match with a high residential density.
frequency of service at an economic price, the best competitive situation for public transport in Edinburgh occurs where lower car ownership rates make it least necessary to be competitive. Conversely, since a major aim in introducing an actively competitive system of public transport is to restrain the demand for access to, and parking facilities in, the central area for private cars, it is in just those moderately low density areas which are assumed to have the highest levels of car availability that the need for a competitive system of public transport is greatest, and the practicability of installing that system is least.

This then is one difficulty in the way of a public transport based solution to Edinburgh's overall transport problems, but leaving it aside and assuming that the busway system, suggested in section 1E above as being the best where the ideal conditions of urban form did not obtain, is adopted in an effort to make the public transport system sufficiently attractive, one may ask to what extent this solution would be possible. The critical consideration would be the possibilities for introducing these busways into the urban fabric. In the current climate of opinion, both lay and professional, it seems likely that the only possibility of doing this would be to exploit the existing rights of way left vacant by railways now closed, or along the Union Canal if that can be spared from future recreational use. Otherwise the urban fabric presents virtually no cracks, especially near to the city centre. Map 25 shows the available railway rights of way in relation to the distribution of population.
in 1961, and although there have been developments along both sides of the railway, likely to remain open for traffic for some time to come, at Wester Hailes, a disbalance between possible busways and the pattern of population distribution remains. This is not surprising in view of the small effect which the railways have been shown, in chapter 2 above, to have had on the growth of the City's suburbs, except in the case of a few small and low density developments, such as at Colinton. More particularly, the almost complete irrelevance of railways in South Edinburgh, with the direction of the South Side and Suburban Line dictated by geographical configurations so that it lies transverse to the travel desire lines to and from the city centre, would lead to problems in providing busways to serve this area. 'Alternatives for Edinburgh' foresees difficulties in overcoming congestion on the approaches to the central area from the south even in its preferred plan, so that if the busway public transport system is to be effective in reducing such congestion, it ought to make a contribution to movement on this southern axis. The compromise of using one of the existing roads as almost a busway, although with other traffic allowed to use it for access to premises, is a practical answer, but not altogether satisfactory from the standpoints of amenity or the maximisation of public transport competitiveness. There is almost certainly not enough population in sufficient concentration on either the Morningside or the Newington approach to the central area to justify the solution of the problem by the very expensive construction of a fixed track.
This map is intended to show how the population of Edinburgh is located in relation to railway rights of way suitable for adaptation as busways or for new fixed track public transport lines. Developments since 1961 have filled out some of the gaps on the west side of the City, notably at Wester Hailes, but the railway lines in this area are likely to retain their present use throughout the foreseeable future.

The following notes apply also to map 24.

The source for these maps is the 1961 census enumeration district data, as used for map 8. The inner limit of the suburbs has been taken as approximately one mile from the old cores of Edinburgh and Leith, defining the suburbs as the areas from which people can not be expected to regularly walk to work in any significant numbers. Because of the data base used, the actual boundary has been drawn to conform with enumeration district boundaries.

The use of a dot map technique involves a certain degree of subjectivity in placing the dots within the boundaries of the areas to which they refer. However, given the small scale of the map, the data base is sufficiently accurate for the likely error to be small, and the overall impression of densities given is as good as is needed here.
rapid transit system in tunnel across the 'grain' of the country on either axis. Approaches to the centre from the north also present some problems, especially from the big council estates in the Muirhouse and Pilton areas, although here there would be a possibility of creating a busway along the course of the former Caledonian Railway’s Leith branch out from the City via Craigleith to Crewe Toll, although this would be a very roundabout route. As the proposals of the preferred scheme in 'Alternatives for Edinburgh' suggest, there are good opportunities for providing busways into the centre from east and west. It is thus doubtful whether an ideal public transport system, even using busways, could be provided to cover the whole of Edinburgh.

However, there are some people who would not reject a fixed track system as readily as has been done here, and therefore the present argument would not be complete if it did not consider the possibilities of such a solution. If one assumes, as seems logical, that the only economically practicable route through the central area is that presently taken by the existing railway, and adding the further reasonable assumption that this railway will continue to exist, then the maximum number of tracks which could be provided for an intra-urban rapid transit system is two. It was shown on pages 21-2 above that the capacity of a single line of rails may be assumed to be 18,000 passengers per hour. Therefore, if an additional and independent line of tracks was laid in from the north to Waverley through the long disused Scotland Street tunnel, a rapid transit system
could conceivably deliver 54,000 people to the central area in a peak hour. Allowing for an inevitable failure to reach this full potential, one may therefore assume that were such a system introduced it could deliver 50,000 of the 93,000 service sector workers in the city centre. Assuming that about ten per cent of these 93,000 people walk to work, other forms of transport will have to cope with about 33,000 worktrips. Taking the forecasts of modal split for 1991 given in 'Alternatives for Edinburgh', paragraph 54, for work journeys into the central area of 56% car to 44% 'bus, and applying them to this residual, gives 18,500 worktrips entering the city centre by car. Figure 11 of the report shows a car driver to car passenger ratio of 53:13 for all home-based worktrips, which would imply that these 18,500 trips would lead to nearly 15,000 cars seeking to enter the central area for work journeys. This total could be accommodated by the number of parking spaces which the report suggests could be made available without too serious an environmental or money cost. Hence, although the calculation...

8. 'Alternatives for Edinburgh', table 2. The figure is more or less the same in both 1968 and 1991.

9. Probably a conservative estimate. The Sample Census 1966, Scotland, Workplace and Transport Tables, table 7 suggests that nearly 16% of those working in Edinburgh walk to work.

1. This will underestimate the number of car trips because some of the potential 'bus users will now be travelling by the fixed track rapid transit system.
involves assumptions which depress the total number of cars, it seems that the most generous provision of fixed track public transport which may be contemplated in Edinburgh, working near capacity, could make an impact on the problem of excess desire for parking in central Edinburgh. However, there would remain the almost insuperable problem of bringing the suburban end of the system to within reach of 50,000 central area workers who would use it. To do so would probably mean serving at least half the population of the City, and to install such a system would be totally impracticable given the nature of population distribution in the suburbs and the poor availability of possible routes.

Another project which receives enthusiastic support in principle is the reopening of some of the suburban railways, on the grounds that any relief of the road system, however small, is worth having. The problem is that all these services were withdrawn because they were not carrying enough passengers to make enough money to be economic, although admittedly the withdrawals took place before the 1968 Transport Act provided for the payment of subsidies where it is felt that the social cost of withdrawing the service justifies it. Because it was the last service to disappear, a front runner in this campaign for reinstatement is the Corstorphine branch. In 1961 about 10,000 people lived within a quarter of a mile of its three stations, although given an adequately frequent service there would be a

2. Figure derived from 1961 Census Enumeration District data.
possibility of some park-and-ride custom from farther afield if conditions in the city centre were sufficiently discouraging. One might guess therefore that such a population would generate between 1,000 and 2,000 trips a day for the railway to carry into the city centre, which is probably too few to justify the cost of reinstating the line, bearing in mind also what was said on pages 88-9 above about the late arrival of the railway in the suburb and the long tradition of successful competition from road services. If, but only if, it could be shown that the line could attract sufficient car users away from using their vehicles for work journeys to reduce the amount of money which would have had to be spent to accommodate those cars, or to attract their users to a 'bus service, by an amount equal to or greater than the cost of providing the train service at a given fare, subsidised or not, would there be a case for reinstating this branch service, or any other in a similar situation.\(^3\)

Given that a public transport system introduced into the present land use pattern of Edinburgh would face the twin problems of its greatest need in attracting car owners away from their cars occurring in areas where residential densities are least suited to its competitiveness, and of potential fixed track system routes not always going in the direction which the pattern of development most requires, one may ask what are the possibilities for adjusting the residential

\(^3\) Opinions may differ on this assertion, but it seems reasonable to the present author.
land use distribution to something which would give public transport a better competitive chance. Because most available land within the Green Belt has already been built up, this adjustment of the pattern would have to be achieved by redevelopment, although it would be useful if an adjustment of the Green Belt policy could be made so that developments along certain fingers potentially servable by a very attractive public transport system were encouraged. There are some possible lines which could be exploited in this way, but they lie beyond City limits and therefore beyond the strict limits of the present study. Within the City, one may postulate from experience that the life of a cheaper dwelling is about a hundred years at present, and that of the better built and more expensive ones is longer. Leaving aside Leith, which is to a great extent self-contained, and which is already of sufficiently high a density of development to support a good public transport link with Edinburgh if the present situation were not as satisfactory as it appears to be, the expansion of Edinburgh beyond a pedestrian radius cannot truly be said to have begun before the mid-nineteenth century. It did not include any low density working class housing until the early council and council assisted schemes of the 1920s, and the older, better quality low density housing is mostly still in quite good condition with apparently a good life expectancy. Therefore there seems to be little likelihood of any major opportunity for redevelopment occurring within the suburbs much before the end of the present century. What redevelopment is undertaken
will almost entirely be of the nearly life-expired tenements which house high density populations in such places as Dalry and Polwarth. There is therefore no prospect that the density pattern will change in favour of public transport's competetiveness in the foreseeable future, but from the public transport point of view a policy of concentrating the various small scale projects, both redevelopments and infill, which do take place in a way which will be amenable to a very long term improvement in the situation will be desirable. Finally, however, to intensify the density begs the question as to what is the maximum desirable on non-transport grounds. This is a question for another study, as is that as to whether these other standards are more important than those of transport needs.

This section has suggested that the advocates of a public transport oriented solution to the problems facing Edinburgh's whole transport network will have difficulty in achieving their end solely by making the public sector competetive. In the light of the history outlined in chapter 2 above they ought to have begun their agitation at the time that the suburban development was taking place, forcing it to take the form of densely developed radial fingers into which the ideal public transport system as outlined in section 1E above could be introduced. Now they are probably too late to do anything except partially by the exercise of a politically unpopular 'Thou shalt not'.
ACCOMODATING PRIVATE TRANSPORT.

Whilst some enthusiasts would have the transport system of the City based on public transport, there is also a body of opinion which holds that there should be unrestricted use of private transport. It is clear from 'Alternatives for Edinburgh' that the amount of land in the central area which would be required for parking if this were allowed would be beyond what was acceptable on environmental grounds. It also seems that the marginal cost per space of the last spaces provided to satisfy the demand may well be beyond what is considered acceptable by the decision takers. Since, as has been suggested in the previous section, in Edinburgh there is probably no hope of diverting sufficient of the demand for travel between suburb and centre from private to public transport without using some form of restraint on private car access to the central area, it appears that, whether one supports a solution favouring public or private transport, there would be an advantage in reducing the total demand for access to the central area, by whatever means, at congested times. Although it was beyond their terms of reference to postulate any change in the land use pattern of the City, the consultants do suggest in paragraph 672 of their report that it would be beneficial if some policy of moving uses at present in the centre out to the suburbs, and of locating all expansion of the types of activity now in the centre there, were adopted.
Several problems would face the implementation of such a policy with regard to existing enterprises. These include the fact that land values where commercial use is established are higher than those where there is residential use. If the moving of one user from the centre to the periphery is going to be of benefit, the site he has vacated must be put to a different use. In most cases the most suitable alternative use will be housing, for housing in the city centre would reduce the desire for movement between centre and suburbs by bringing workers closer to their work, and it would also contribute to the solution of other planning problems, such as that of the increasing lack of life in commercial districts after business hours. If such an alternative use is to be made of the vacated site, some means must be found of relieving the housing of the excess land value generated by its past commercial use.

A second problem is that the extent to which the movement of activities is possible is severely limited. In most cases it can only be done when building redevelopment is undertaken, because of the need for a change of use if the move is to have the desired effects. In general, office blocks and factories which have been purpose built, or even rebuilt within domestic facades, as is the case with some offices in central Edinburgh, are unsuitable for residential use. Further, one reason why there has come to be a concentration of offices in city centres is the significant degree of linkage which appears to exist between them. For most concerns it would be undesirable to move any but
the most routine of their operations away from the hub of activity. With retailing, Edinburgh's central area serves a particular regional function, and it would almost certainly be undesirable to move any shops serving this regional, or even City-wide, market out of the centre. However, there are some elements of the fringe central area shopping which serve only a part of the city. Examples are Tollcross and Nicholson Street, both of which the post-1920 development of the City has left eccentric to the population which they apparently serve, and in both cases impending redevelopment offers an opportunity to resite a large part of their activities, leaving only such shops as are necessary to support the needs of the immediate local population and other non-retailing activity. Sites for such a relocation are available at Wester Hailes and at Nether Liberton.

It seems a reasonable assumption that there will be an increase in the level of activity in service industries traditionally associated with the central area. Such expansion will lead, in the absence of preventive policies and on the basis of previous experience, to an expansion in the area occupied by such activities or to an intensification of the use of existing land. Either of these developments would increase the number of central area jobs and hence worsen the congestion problem. If there was a successful relocation policy in operation, the advent of new undertakings in the centre would negative even the small results achievable by such a policy. Therefore, as much new development as possible must go to suburban sites, and there are indications
that the existing control on office and hotel expansion into the remaining residential streets of the New Town is being accompanied by such a movement. The interdependence of so many small concerns, however, limits the extent to which this new development can be confined to the suburbs. If more legal firms are needed they cannot be expected to prosper at Corstorphine, so far from the Courts, from Register House, and from other firms. On the other hand, computer centres, large concentrations of clerical workers doing largely routine jobs, wholesaling, warehousing, and suchlike developments have no need to be in the centre, and so, just as such enterprises offer opportunities for decentralisation, new developments in these fields can go to the suburbs. It is also interesting to note that there are two large hotels presently under construction in the Corstorphine area, where they are well sited in relation to the main approach to the City from the west. However, the fact that the Esso Motor Hotel on the Queensferry Road at Craigleith station has taken the somewhat unusual step of placing relatively lavish advertisements in the national press suggests that the practicability of decentralising the tourist trade has been misjudged by entrepreneurs, so that planners should treat the possibilities with caution.

Thus it appears that there are possibilities for at least preventing a rise in the level of employment, and hence traffic generation, in congested central Edinburgh by channeling new service sector employment to suburban sites as far as possible, and by decentralising some activities from the old
heart of the City. Moreover, as was suggested on page 127 above, there are signs that a natural trend in this direction has begun, partly as a response to congestion problems. The important thing in accommodating this movement is to learn the lesson of the central area and make the emerging land use distribution compatible with the transport system. Thus the new locations for the activities should be at points in the transport system which can offer a good level of accessibility without suffering the congestion problems which arose in the central area because of the way its good accessibility was exploited. Wester Hailes, Nether Liberton, Leith and several other places would meet this criterion given a road system akin to that of the preferred solution of 'Alternatives for Edinburgh'. Locations which are badly sited in relation to transport will suffer not only from congestion but also from difficulties in attracting adequate suitable labour and from customers finding it difficult to avail themselves of the facilities offered.

However, even if such pitfalls are avoided, the problem remains as to whether sufficient central area activity can be decanted from Edinburgh's centre to its suburbs to bring about the necessary reduction in trip generations from the former without damaging its viability as a commercial, retailing, and tourist centre. It might be argued that such damage would not matter, but it seems to be taken as an article of faith in the City that it would be highly undesirable if the centre were to contract beyond the limits of viability at its present level of functioning. To give
an answer to this question is beyond the scope of this study, but it may be postulated that decentralisation, like parking charges or public transport, could not provide the whole answer to the problem of reducing the demand for peak hour private car access to the central area to a level which can be accommodated by the road system without congestion, and by the parking provision without bringing into use unacceptable sites. This problem has arisen because of the way in which the City developed without public transport playing a guiding role, and without a decentralisation of non-residential activities on a scale matching that of the decentralisation of housing. It appears that its solution will be a compromise between the various factors involved, including those discussed in this chapter. Probably the preferred scheme of 'Alternatives for Edinburgh' represents a typical and operable example of such a solution. Ideal solutions only seem to be applicable where cities have been designed around them, and it is to the general applicability of this point that the final chapter of this dissertation is devoted.
Chapter 4.

GENERALISATION.
Section 4A.
LESSONS FOR THE RELIEF OF CONGESTION IN EXISTING CITIES.

In section 1B it was suggested that the form of urban growth was dependent on the interplay of a number of factors, some of which were there listed. At the same time it was pointed out that the pattern of urban growth which has been typical of cities of the British type, where the residential areas have developed as a ring around the urban core, has led to problems of congestion in that core, especially when there is a peak demand for movement between the residential areas and the employment concentrated in the city centres.

The exact nature of the growth pattern and of the congestion problem will naturally vary from city to city in accordance with differences in their functions and other factors, but the problem is a general one. Indeed, if the timing of its response is a reliable indicator, Edinburgh experienced the problem in a form acute enough to need a remedy much later than most cities of comparable size and importance. The Scottish Capital derived great benefit to its traffic flows from the removal of the commercial centre into the spaciously laid out streets of the New Town, and this benefit has been increased by its slower increase in car ownership rates than has been the case in cities like Birmingham. These factors have apparently combined to make it unnecessary for the City to seek a solution to its traffic problem before the 1960s.
Towns which found it necessary to attempt a solution to central area congestion before this time have usually adopted the plan of providing additional road space to cope with the demand, although this is often self-defeating in that new traffic appears to be generated in sufficient quantity by the new roads to return the congestion to its previous level, with a worsening in some places not yet relieved. It was opposition to the proposal to introduce a typical solution consisting of a new ring road close to the city centre and the upgrading of the radial roads leading to it which led to the investigation which has produced 'Alternatives for Edinburgh'. This opposition arose not only from the relatively poor results which were being achieved in some existing instances of this type of solution, but also from the emergence of a powerful body of opinion amongst certain of the decision taking classes in Britain and elsewhere that the past emphasis on urban road construction has been wrong, and that social and aesthetic considerations ought to take precedence, so that instead of accommodating the car in cities the use of private transport should be restricted to what each city in its existing form can cope with. Hence, in the studies published in 'Alternatives for Edinburgh' so called 'planning' and 'environmental' considerations have been given great weight in the assessment, and in cities throughout the world increasing attention is being paid to public transport.

In chapter 2 it was shown that, in the case of Edinburgh, the public transport system played a relatively neutral role.
in determining the form of the City's growth, and in chapter 3 it was demonstrated that this poses problems for public transport based solutions to its central area congestion problems. Similar considerations may obtain in other cities, although it must be admitted that Edinburgh gives a singularly open impression when compared with more industrialised cities in Britain. If research in other cities did show the type of growth that was found in Edinburgh, even in a slightly different form, then many of the arguments of the last chapter may hold good there, even if there is not as severe an aesthetic constraint on parking provision as tourism and sentiment impose on Edinburgh. Public transport will be difficult to fit into the existing urban pattern, and if it were it would probably be difficult to provide a service sufficiently near to the ideal to attract enough passengers to make a significant impact on the level of congestion in the central area. The scope for increasing the attractiveness of public transport by adjusting the distribution of residential land use to something nearer the optimum of high densities concentrated along potential radial fixed track transport lines is almost certainly as small in most cities as it is in Edinburgh. Similarly, there will normally be little scope for decreasing the demand for movement between suburbs and centre by decentralising activities. The exact possibilities will differ from city to city, and where, as in Manchester, warehousing has been an important activity on the periphery of the central area there will probably be more scope for action than in Edinburgh where such activities are
not now present on any significant scale. 'Alternatives for Edinburgh' showed that in the case of that city it would be possible to achieve a solution to the transport problems of the town which accommodated all the predicted desire for movement, provided that the community was willing to devote enough resources of money and land to that end. In Edinburgh the community is unwilling to release central area land for roads and parking places, and this imposes severe restraints on the system. Other communities do not, in general, have such a severe limitation, and are probably willing to allocate enough resources to achieve something closer to unrestrained use of private transport, but the climate of opinion in which such decisions are taken has recently been moving away from favouring completely unrestrained private car usage. Hence the general conclusion reached that the solution to Edinburgh's transport problems would almost certainly have to be a compromise between accommodating private transport, promoting public transport, and adjusting the land use pattern where possible probably holds good for other cities, although the necessary mix will certainly differ from place to place.

A common cry of the anti-road lobby is that free or cheap public transport would attract many customers away from their cars, thus easing the problems of central area congestion. Whatever the political attractions of such a scheme, enough has already been said in this study, particularly in chapter 1, to call into question the usefulness of such measures as tools of integrated transport system management. It was
shown in section 1D, page 25 above, that cost is seen by operators as only a secondary factor in marketing public transport, and this suggests that demand is relatively inelastic in terms of price. Car ownership rates are indisputably rising, and the corollary of this is that the total demand for public transport at a given price is probably falling, although, because the price of public transport is rising, it is not easy to isolate this effect, and the supposition needs to be tested by other work. What seems probable is that even 'free transport would have relatively little effect on demand, although it might hold it steady at or about its present level for a time, after which the car ownership effect might be expected to come into play again. Subsidised public transport may lead to some reduction in the demand for the use of private cars in city centres, but, because, as has been shown in chapter 3 above in the case of Edinburgh, it is difficult to make the system attractive on its more important competitive points, the case for subsidisation can really be justified only after a thorough examination of likely user behaviour and in the context of a cost and benefit analysis of the whole transport system, public and private.

In other words, the study of Edinburgh, taken in conjunction with the more general considerations outlined in this section, suggest that the possibilities for achieving a solution to transport problems in modern cities by using public transport are too easily overrated. The cities were not designed around public transport, which makes its
reinvigoration no mean task. Compromise seems almost certain to play a key role in the solution of transport problems in existing cities, although there is evidence to suggest that the role of public transport will be bigger in bigger cities where it is more economical to install something approaching the ideally competitive system. Enthusiasts would probably do better to turn their attention to new cities where there is scope for matching activity and movement so that the system does not become overloaded. Such prospects are discussed in the second and last section of this chapter.
This section discusses the role of transport considerations in new developments, bearing in mind what has been learnt so far in the study concerning the importance of planning development around the transport system if the latter is to function satisfactorily. In the ideal cities of More and Howard, the total size of the settlement was such that pedestrian circulation alone was adequate for intr-urban movement, and indeed More was writing at a time long before the technology to expand beyond this size was available. However, because the aspirations of society seem to have become more movement orientated than formerly, the visionary cities of modern theoreticians are often transport dominated. An example is Jellicoe's 'Motopia' which has continuous buildings laid out so that the roadways for private transport run at rooftop level, leaving the ground free for pedestrian circulation and public transport, which, in the Thames-side site considered in the book, would have been by waterbus.

However, such visions are far removed from what is being

5. Ebenezer Howard, 'Garden Cities of Tomorrow', late nineteenth century.
put on the ground. The British New Towns illustrate many of the ideas used, although they are mostly much smaller in scale than Edinburgh. The first generation of post-1946 New Towns were designed according to the zoning and residential neighbourhood theories then dominant in planning practice, but the accommodation of internal circulation was not altogether forgotten. Thus Harlow, for example, has two industrial estates rather than one so that the worktrip flows were not too concentrated. However, the design concepts were based on the contemporary pattern of transport usage in towns of similar size, and this meant that public transport was not given a dominant role, but rather the system catered for the unrestricted use of the private car in increasing numbers. Thus in Harlow today the 'bus services are unattractive to people who can use a car.7

In the later New Towns transport has seemingly had a greater influence on the basic design concepts, as is demonstrated by Cumbernauld which was designed around free movement for both private cars and pedestrians. The latest 'green field' New Town, Milton Keynes, takes the process further into a city whose planned size is of a similar order to Edinburgh. Here the concept is of a completely 'motorised' population with unrestricted use of private transport, and

7. This last piece of information is from a resident of the town. The problem is compounded by the difficulty of recruiting 'bus crews in this part of suburban London, so that the service is unreliable.
with the residual public transport demand catered for by a demand activated 'bus system, as mentioned on pages 22-3 above. By way of a contrast, the Swedes in Stockholm have designed their suburban extensions to this city of 800,000 or so people around a public transport system linking focal points in the suburbs by new urban railways to the formerly congested central area. Public transport considerations appear also to have influenced the design of Runcorn New Town in England, which includes the first British example of the application of the busway concept.

This review demonstrates the application of the principle of building around the transport system if the problems of congestion arising from the inadequacy of the road system to carry the load required of it are to be avoided. In the British situation it will probably be better in general to work on the assumption that there will always be some sort of private transport vehicle with the four characteristics outlined on page 14 above generally available, and therefore to design like Milton Keynes with the trend of demand. To succeed in the execution of a plan which seeks to restrict the treasured freedom of the individual to use his own transport would require that everything else was in favour of the planner who tried to do so. The early New Towns around London have been conspicuous in their failure to be independent of the Wen, which was their designer's intention but not the wish of their citizens. Likewise one can envisage a town designed around ideal public transport with a view to restricting the level of demand for private car
usage failing to function because people would not play
along with the intentions of the plan. Sic Transit Gloria.
In the introduction to this study, on page 3 above, it was stated that the aim of the work might be expressed as follows:

'To investigate the relationship between the availability of public passenger transport between residential areas and areas of other activities and the direction, density and nature of the areal expansion of the City of Edinburgh from about 1830 to the present day, with a view to partially evaluating the current proposals for the transport system of that City over the twenty years 1971 to 1991, and to deriving general lessons about the part that transport must play in the planning of urban growth if there is not to be a problem of congestion.'

Taking into account the definitions of the study as elaborated with this statement in the introduction, this investigation has led to the principal conclusion that urban growth must be designed around the transport system if that system is to be congestion free.

Most cities, including Edinburgh, experience a problem of traffic congestion in and around their centres, largely because business, commercial and administrative activities have remained there whilst most of the residential development has been devolved to the suburbs and the country beyond. From these areas people can no longer walk to work as they once did. Whilst the functional differentiation of cities
has given rise to this problem, it has been aggravated, since the advent of mass-produced private transport in the present century, by a swing away from public transport in favour of the relatively cheap but space consuming private motor car. This is the result of the comparative characteristics of the various types of transport, which also suggest that the most competitive types of public transport can only achieve their full potential if the population to be served is concentrated along their routes. It is a not uncommon assumption that the growth of cities has been so conditioned by public transport that they naturally possess, to some degree at least, this condition of linear concentration which would give an ideal situation for public transport. However, published work, such as Kellett's study of the impact of railways on Victorian cities in Britain, suggests that this is far from the case.

The case study of Edinburgh presented in this present work reinforces the view that a city's growth is not conditioned by public transport to anything like the extent that would have left the city in a form which would receive an ideally attractive public transport system in modern conditions. The development of the technology of public transport gave rise to possibilities for development beyond the limits which would have been imposed on urban size if it had had to depend on pedestrian movement alone, but they were not a sufficient condition to stimulate that development.

Many other factors affect the manner of urban growth, and the transport system has been accommodated to their influences.

The recent consultants' report, 'Alternatives for Edinburgh', sets out to solve two distinct but interrelated problems which it expects to confront the City's transport system in the next twenty years. The easier of these two problems to solve is the accommodation of an expected increase in the demand for inter-suburban travel, but the characteristics of such movements are such that they are not very amenable to accommodation by public transport, so that there will almost certainly have to be some increases in suburban road space. The other problem is that of central area congestion, and this gives rise to serious difficulties because its solution involves value judgements in the 'trade-off' of additional road and parking space provision against loss of amenity.

In particular, 'Alternatives for Edinburgh' concludes that it will almost certainly be difficult to provide sufficient parking space to meet the unrestrained demand in central Edinburgh. Study of the ways in which demand could be reduced, including parking policy, public transport reinvigoration, and the decentralisation of central area activity suggests that the final solution can only be a compromise mix of these various methods, each of which is insufficient on its own.

Taken into the broader sphere of planning, it appears that, insofar as what is true of Edinburgh is true of the development of other cities, the conclusions reached in respect of Edinburgh have general applicability. In
existing cities which have not been designed with special reference to transport needs, solutions to the problems of central area congestion will almost certainly have to be a compromise involving partial answers from a number of ideal systems. A pure road system could possibly be used if the community was willing to pay for it, but in present conditions this seems unlikely. On the other hand, the politically popular public transport answer would have to operate in conditions so far from ideal as to present serious difficulties as a complete answer, unless it were accompanied by politically unpopular restrictions. This suggests a need for extreme caution in approaching any ideal proposal. In major new developments, transport must take an important place in the design process if problems are to be avoided, and this probably implies a design which accommodates the use of private transport.

Because it does not set out to do so, this study does not give either a complete picture of the development of Edinburgh since 1830 or of the role of transport in guiding urban form. However, it is hoped that sufficient material on both these counts has been presented to guide the reader through the argument as outlined above. Much of the reasoning has been from the evidence of the ground, and it is hoped that this has been read correctly. If Cobbett could deduce a decline in the English population from a

9. William Cobbett, 'Rural Rides', c.1820. Modern opinion is that the population had been rising for some centuries.
calculation as to what the churches could have held, lesser observers are falling into a sanctified trap if they interpret the ground to suit the ends of their argument, so it is hoped that the reader will accept this as an apology in case he feels that there are some unintentional interpretational non-sequiturs.

Finally, the author must return to Comely Bank, from whence he started, and admit that he can still offer no answer as to whether the indubitably high densities of residential development in this area have any relation to the influence of the tramway which ran thither.
CAR PARKING COSTS AND CHARGES.

The supply of parking space falls broadly into two categories; on-street and off-street. Off-street parking may be provided by public or private bodies, but in either case it is clear that the operation involves three types of expenditure; land acquisition, construction costs, and operational expenditure (supervision and maintenance). These costs must be born by someone, be it the user, his employer, the public at large, or some combination of these. In modern circumstances it is rare for the whole cost of parking in the centre of towns of any size to be borne by the public at large through the provision of free off-street publicly provided car parking. With on-street car parking the case is somewhat different because the streets have traditionally in Britain been provided at public expense. However, a parking place on a street gives rise to exactly the same type of costs as a parking space off the street, and so one can justify charging for that also on the grounds that there is a cost to be born.

Within a given town the average cost per space of parking provided tends to rise as more parking spaces are added because there is a natural tendency to use the cheapest sites first, although, as the following table shows, the rise in costs may not be smooth, and the cost for a given number of spaces may vary between different schemes requiring different mixes of sites. Notwithstanding this, it seems reasonable to represent the supply costs for parking by a
The cost of parking in the schemes tested in the work on Edinburgh is as follows, derived from 'Alternatives for Edinburgh', table 9;

<table>
<thead>
<tr>
<th>Scheme</th>
<th>No. of places*</th>
<th>Capital cost** (£M)</th>
<th>Capital per space*** (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1/1</td>
<td>16,800</td>
<td>10.3</td>
<td>643</td>
</tr>
<tr>
<td>A2</td>
<td>16,700</td>
<td>11.7</td>
<td>701</td>
</tr>
<tr>
<td>B1 and E</td>
<td>23,700</td>
<td>18.1</td>
<td>764</td>
</tr>
<tr>
<td>C</td>
<td>23,700</td>
<td>18.2</td>
<td>768</td>
</tr>
</tbody>
</table>

* Off-street  
** Land acquisition plus construction  
*** $(2)$ divided by $(1)$

To translate these figures into a cost per space per day one may do the following calculation, which takes a figure of £700 capital per space, including both land acquisition and construction, this figure approximating to the cost in scheme A2 above, which is nearest to the consultants' preferred scheme for Edinburgh. Attendance costs are assumed to be £4 per space per annum, and the repayment of the money borrowed to pay for the space is assumed to be repaid over ten years, with an interest rate of 10% per annum on the outstanding balance each year. For simplicity the
interest has been equalised over the repayment period.

1) The annual repayment of capital will be £70.

2) The total cost of interest will be

\[ \sum_{x=1}^{10} \frac{10}{100} \times (700 - 70(x - 1)) \]

\[ = \sum_{x=1}^{10} \frac{1}{10} \times (770 - 70x) \]

\[ = \frac{1}{10} \times 770 - \sum_{x=1}^{10} \frac{1}{10} \times 10 \times 70x \]

\[ = 770 - \frac{1}{10} \times 10 \times \frac{11}{2} \times 70 \quad * \]

\[ = 770 - 335 \]

\[ = 435 \]

\[ = 135 \text{p. per annum} \]

3) Hence, including supervision, the annual cost per space will £112 - 50p.

4) An allowance for maintenance might make this cost up to £115 per annum.

5) The year may be assumed to consist of 52 five day working weeks, and assuming that weekend use balances non-use during the week, this means that the £115 must be spread over 260 days of parking, which is equivalent to a daily cost of about 45pence, or about £8 - 80p. for a four-week period. For comparison, at the present time an Edinburgh Corporation Transport four week season ticket gives

\[ \sum_{x=1}^{n} x = \frac{n(n + 1)}{2} \]
unlimited travel on the Corporation's 'bus services for a charge of £3 - 75p. \(^1,2\)

If one now considers the demand for parking space, it is apparent that this is determined by the price of that space, and also by the perceived likelihood of finding a place. \(^3\) Thus both pricing and the quantity of parking provided can be used to control parking demand, but the present analysis will concern itself solely with price. As far as one can judge, the demand for parking space falls away slowly as the price is increased, but is in economic terms relatively inelastic. There may be threshold levels at which there is a slightly more marked falling off, but for the purposes of this analysis it seems reasonable to represent the demand for parking by a steeply sloping line, as on the figure below.

The Government's attitude to parking charges, as set out in 'Parking in town centres', \(^4\) is that parking charges should be set in accordance with parking policy in the town in question. If some car parking for general use is to be provided by private enterprise, then the charge for publicly

1. Charge as from 9th April 1972.
2. Economist's advice suggests that the assumptions on which the parking cost calculation is based are realistic.
provided spaces ought not to be less than would be required by the profit needs of that private enterprise. Where demand for parking is very high it may be necessary to introduce charges in excess of the economic level in order to implement a policy. The actual policy adopted will depend on the politicians' analysis of a diagram which will probably look something like that presented here, and on the general policies adopted towards the transport system as a whole. In Edinburgh it is foreseeable that the politicians will not feel able to levy charges high enough to bring the demand down to the possible and acceptable level without restraining the demand also by restricting the supply, although, as the calculation on page 170 shows, the charges per day which are economically justifiable are much higher than the charges at present levied. In addition to setting the overall rates of charge, the politicians and the transport planners will have to decide how to vary these rates between the different types of user in accordance with the needs of their overall policies. For example, in the Edinburgh situation there may be a case for cross-subsidising short-stay parking for shoppers and tourists out of profits on long-stay commuter parking.

However, there are certain difficulties which ought not to be overlooked when setting the levels of parking charges. In many cases it is apparently likely that these charges are born not by the actual traveller but by his employer, who will probably pass it on to his customers. Such free parking spaces or parking season tickets may be issued not only to people who need to use their cars for business
purposes during their working hours, but also as a perquisite to attract key personnel who will use their vehicles only to travel to and from work. Admittedly many of these latter people are probably in a socio-economic group who would use their cars whatever the cost, and there seems to be little hope in any case of diverting this rump from private to public transport.

Again, whilst it is fairly easy to accurately cost given amounts of parking, to predict the relationship between charges and demand needs careful research and, in the present state of knowledge, a large portion of inspired guesswork. Some work is available on parking behaviour^5 but more needs to be done and the results more widely disseminated before a reliable assessment of the effect of a charge can be arrived at. There is also the problem that if an entrepreneur feels that he is not getting his parking at a realistic rate in central Edinburgh, he may take his business not to Corstorphine, as the plan might have intended, but to Glasgow, or even Köbenhavn. It may be that the City can afford this loss, but this is unlikely, and insofar as the costs also affect key workers who may also take their labour to a cheaper city, there are certainly potentially serious consequences to be considered in setting very high parking charges for commuters.

Consider now the supply and demand diagram for parking space given on the next page. If the supply of parking

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5. For example, G. J. Roth, op. cit. 1965.
were adequate and no charge were made, the number of spaces required would be represented by OD, but the provider of those spaces makes a substantial loss. If, however, he wishes to just break even on the operation whilst leaving no unsatisfied demand, he must provide the number of spaces represented by OEs at a charge represented by OEp. In the
case of Edinburgh it seems likely that there would be environmental objections to providing more spaces than might be represented by OSm, which leaves the politician a problem. It will cost CCM to provide these spaces, at which price the demand for spaces would be OUm, so that if the break-even charge is set for the OSm spaces, there will be an unsatisfied demand represented by SmUm. The alternative extreme would be to set a charge of OPM, at which level there would be no unsatisfied demand, but the operator is making a profit per space equivalent to CmPm. In fact, the solution adopted may well be to charge OPa for the OSm spaces, giving a profit of CmPa and an unsatisfied demand of SmUa. In the past it has often been the case that the charges levied for parking have been kept very low, such as OPx, but to set such a charge would leave a substantial unsatisfied demand, SmUx, if only OSm places could be provided. Nowadays, a politician would probably find little difficulty in accepting a charge CCM for OSm spaces, on the grounds that the community cannot be expected to subsidise parkers who form only one segment of that community, but the question is how big a value will he accept for CmPa and SmUa.

In Edinburgh, CCM is about 45 pence per day, as has been shown, and OB, the maximum cost of an intra-urban return 'bus journey, is, from 9th April 1972, 18 pence (unless a change of vehicle is involved). Note also that at a price OPA UdD does not represent unsatisfied demand, because OD is the demand for parking only if it is free, and similarly for the other combinations.
NOTES ON THE 'POST OFFICE DIRECTORIES'.

What is now the 'Edinburgh and Leith Post Office Directory' is an annual publication which began life as 'The Post Office annual directory from Whitsunday 1805'. It was intended as an aid to the letter carriers of the early nineteenth century, listing in alphabetical order by name the trades and addresses of Edinburgh citizens. It has changed much over the years, and has been renamed twice. From the 1846/7 edition it was called the 'Post Office Edinburgh and Leith Directory' until the 1918/9 edition, when it received its present name.

Since the 1833/4 edition the Directory has included a section arranged by streets, and these lists have formed the basis of the street dating used in the present study to date the growth of the City. For the main part of the work the lists in the 1833/4 edition and then every ten years from 1871/2 to 1961/2 were used, concluding with the 1968/9 and 1969/70 editions. Several problems were encountered, including the following:

a) Some minor streets appear and disappear several times through the years.

b) In many cases the names of streets have been changed over the years, and, although the Directory gives much helpful information on these changes, it does not always occur that this information is conclusive.

c) Before outlying areas become included in the general
built-up mass of the City, the Directory often lists individual houses, and where these houses have given their names to streets subsequently built on or near their land, there is a potential source of confusion which one cannot be certain of avoiding.

d) Many of these outlying areas also present difficulties in extracting information for dates prior to their inclusion in the City because, for dates prior to 1900, street names have to be extracted from alphabetical lists of personal names in the 'County Directory' section of the book. In neither of the last two cases can completeness be assured, nor confusion between houses and streets of the same name be avoided with any degree of certainty. However, bearing in mind these difficulties, a street's first appearance in the Directory seems to be a reliable indication of the date at which its development was initiated.

From the middle years of the nineteenth century, a street map has been published to accompany each edition of the Directory, and these maps have been referred to in the present work, although their most important use has been to locate the City boundary between 1856 and 1920.
BIBLIOGRAPHY.

Key works:

'Edinburgh and Leith Post Office Directory', Edinburgh, annually. See appendix B.


J. R. Kellett, 'The Impact of Railways on Victorian Cities', Routledge and Kegan Paul, London, 1969. This work has been useful principally as a source of ideas.


Other works (main text):


'Bradshaw's August 1887 Railway Guide'.

'Bradshaw's April 1910 Railway Guide'. Both consulted as recent reprints by David and Charles, Newton Abbot, Devon.


'Edinburgh Studies', Institute of Public Administration, Edinburgh, 1939.


Periodicals;
'The Scotsman', Edinburgh, daily. Various issues around 1886 and 1935 were consulted.

'Modern Railways', Ian Allan, monthly. (Especially recent issues.)

Further press references were consulted in the 'Housing Press Cuttings' of the Edinburgh Library, Edinburgh City Libraries.
Acts of Parliament:
The following Acts have actually been consulted;

- Tramways Act 1870
- Housing of the Working Classes Act 1890
- Housing, Town Planning, etc. (Scotland) Act 1919
- Edinburgh Boundaries Extension and Tramways Act 1920
- Housing (Scotland) Act 1966

Census of Scotland:
Relevant reports of the censuses from 1861 have been referred to.

Allusions:
- William Cobbett, 'Rural Rides'.
- Ebenezer Howard, 'Garden Cities of Tomorrow'.
- Thomas More, 'Utopia'.

Bibliography for Appendix A:
I would like to express my thanks to the following people for assistance received;

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To my colleague Colin Beeby for assistance in locating some of the references used for Appendix A.

With these exceptions, the thesis represents my own work.
The text has been entirely composed by myself and all opinions expressed in it are entirely my own responsibility.

Peter J. Page
19th April 1972.