# AN EVALUATION OF THE FACILITIES FOR DISABLED PEOPLE ON THE TYNE AND WEAR METRO

VOLUME I

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An Evaluation of the Facilities for Disabled People on the Tyne and Wear Metro

Abstract

The Tyne and Wear Metro is a modern light rail transit system which was opened in stages from 1980 onwards. Provision for disabled people has been made so that the system is intended to be fully accessible throughout. This thesis comprises an evaluation of these facilities for disabled people and the main findings are as follows:

i) The system was not originally intended to incorporate facilities for disabled people, but a gradual change of policy resulted in the provision of full access;

ii) Surveys of disability indicate that about 7% to 8% of the population of the Tyne and Wear area suffer from some disability. However, those disabled people most likely to use Metro and benefit from its facilities (i.e. non-housebound, physically handicapped or visually impaired people) together comprise only about 2% of the Tyne and Wear population;

iii) Only a minority (perhaps one-third) of local disabled people use the system and disabled people account for only about 0.5% of Metro passengers. However, the facilities for disabled people are also used by non-disabled passengers, such as people with prams, push-chairs, luggage, shopping, and so on. In fact, these non-disabled users considerably outnumber disabled users;

iv) The ergonomic performance of the facilities for disabled people was varied. Provision at new purpose-built stations was generally more satisfactory than at older stations taken over from British Rail, even where the latter had undergone some modernisation;

v) Among disabled people who had not been on Metro, non-use

Abstract (continued)

appeared to be mainly due to poor overall mobility rather than any specific problems with Metro;

vi) A social cost-benefit analysis nevertheless suggests that the total value of all benefits likely to accrue from the facilities for disabled people will, over time, offset the capital cost and also provide a social return on investment. This is mainly due to the large number of non-disabled, but "legitimate" users of these facilities. Costs per trip also compare very favourably with other forms of transport for disabled people.

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# CHAPTER 1 :

# INTRODUCTION

## 1.1 Objectives of the thesis and outline of Chapters

The possibility of undertaking research aimed at evaluating the facilities for disabled people on the Tyne and Wear Metro was first considered in 1981/82. A project description was drawn up by the Division of Transport Engineering, Department of Civil Engineering, University of Newcastle upon Tyne and the Transport and Road Research Laboratory (TRRL). It was hoped that financial support would be available in the form of a Co-operative Award in Science and Engineering (CASE) studentship from the Science and Engineering Research Council (SERC) with TRRL as co-operating body. A studentship of this kind was awarded in order for the project to begin in October, 1982. According to a booklet published by the Science and Engineering Research Council (1981), CASE studentships:

> "provide for the training of a research student on a suitable approved project which has been jointly devised and is to be supervised by a university or polytechnic department and a co-operating body in the public or private sector."

The aims of the CASE scheme, as stated by SERC, are to encourage links between academic institutions and outside bodies and also to provide research students with experience of working outside the academic environment. To return to the project brief, the primary objectives of the research were given as follows:

i) To determine the nature and size of the target group for whom the facilities were intended;

ii) To survey the use made of the special facilities by people with different types of disability;

iii) To establish the impact of the special facilities on the travel patterns, both of the target group of disabled people and also of other users of these facilities;

iv) To determine the attitude of users and non-users in the target group to the facilities provided;

v) To evaluate the effectiveness of the special facilities as regards the needs of the target group, and to identify any conflicts between the requirements of people with different disabilities;

vi) To identify groups of able-bodied people who are affected, beneficially or otherwise, by the physical provisions of the special facilities;

vii) To evaluate the effectiveness of the special facilities in the more general context of the travel needs of disabled people.

Attention was drawn in the project brief to the fact that the facilities for disabled people were not part of the original system plans but had been added on when design work was already well advanced.

To a great extent, the project owed its conception to links which had already been established between TRRL and Newcastle University. The Transport Operations Research Group (TORG), which is part of the Division of Transport Engineering, had already begun a number of studies under contract to TRRL concerned with Metro and also with transport for disabled people. In addition, TRRL had carried out other research into the travel needs of disabled people. Consequently, an evaluation of the facilities for disabled people on Metro was seen as complementing the existing research programme of both bodies. In accordance with the terms of the SERC CASE studentship, a significant amount of the work on this thesis was carried out at TRRL and due acknowledgement of the individuals concerned has been made earlier. In addition to the Introduction, this thesis contains six Chapters. All the objectives given in the project brief were fulfilled, the manner in which this was carried out being given in the following outline of Chapters.

Chapter 2

As already mentioned, the facilities for disabled people on Metro were not part of the original system plans, but a policy of making provision for disabled people evolved as design work progressed. Chapter 2 therefore gives the history firstly of the decisions to build Metro and secondly of the gradual changes in policy which led to the incorporation of facilities for disabled people.

Chapter 3

The first objective given in the project brief (see above) was that of determining the size and nature of the target group of disabled people for whom the facilities were provided. By using data from several national and local surveys, Chapter 3 gives details of the numbers of people with various disabilities in Britain and in the Tyne and Wear area. The Chapter also includes information on the characteristics of the disabled population, i.e. car ownership, housing, mobility and so on.

Chapter 4

This Chapter seeks to examine the use of Metro by disabled people. Various surveys at Metro stations, aimed at establishing the number of people with different disabilities using the system, are examined. In addition, the numbers and categories of non-disabled people using the facilities for disabled people will be ascertained. These results will also be discussed in relation to the total number of all Metro passengers. In addition, surveys and investigations into disabled people's opinions of Metro will be described.

Chapter 5

In order to establish the effectiveness of the facilities on Metro vis a vis the needs of particular groups of disabled people, this Chapter comprises a detailed ergonomic analysis of these facilities. This analysis is carried out by comparing the facilities which exist on Metro firstly with various sets of specifications for such facilities and secondly with the results of the surveys first described in Chapter 4. Taken together, Chapters 4 and 5 achieve objectives (ii), (iii), (iv), (v) and (vi) as given earlier.

Chapter 6

Any investment entails the use of scarce resources and investment decisions involve opportunity cost. It is therefore appropriate to carry out an economic evaluation of the facilities for disabled people, in further pursuit of objective (vi) in the project brief. Since Metro and the provisions thereon for disabled people were intended to be public goods, this economic evaluation was carried out according to established principles of social cost-benefit analysis. Chapter 6 contains a brief description of the principles involved, together with an evaluation of the costs and benefits of these facilities, based on different assumptions of usage. In addition, various alternative forms of transport for disabled people are described. The cost-effectiveness of these alternatives is compared to that of the facilities on Metro, in fulfilment of objective (vii) in the project brief.

Chapter 7

Finally, this Chapter contains a brief resume of the findings in the preceding Chapters, together with a discussion of possible further areas of research. Wider issues concerning disability and the travel needs of disabled people are also analysed, in order to complete the fulfilment of objective (vii) in the project brief.

The facilities for disabled people on Metro are the product of a considerable change in attitudes over the past 10 to 20 years towards disability and disabled people. Traditionally, disabled people were generally cared for either in extended families or in institutions. Any efforts at rehabilitation were mostly directed towards younger disabled people, with the emphasis on training people to cope with their environment rather than on altering the environment to suit the needs of disabled people. Moreover, it was not thought that severely disabled people, such as wheelchair users, would want to be very mobile or would require access to buildings, public transport and other facilities.

Attitudes began to change in the middle to late 1960s, when it became apparent that increased life expectancy in most Western nations would result in increased numbers of elderly people. In turn, the number of disabled people would also rise, since many disabilities are age-related. This realisation, coupled to a greater concern for the quality of life, eventually brought about a change in attitudes and a new emphasis was placed upon the rights of disabled people to lead as full a life as their able-bodied fellows. Initially, much of the impetus behind these new attitudes came from the USA, where the experiences of the Vietnam war and the emergence of an influential "veterans' lobby" of disabled ex-service men gave added strength to arguments in favour of improving the lot of disabled people.

As a result, the right of access for disabled people to buildings, facilities and society in general has become widely accepted. 1981 was declared by the United Nations to be International Year of Disabled People: this was both a symbol of the extent to which the needs of disabled people were recognised and also a stimulus to further effort. There can be little doubt that as a result of this shift in attitudes, most disabled people now enjoy a greater integration into society than would have been the case 10 or 20 years ago. However, this alteration in the way society views disabled people has not solved all the problems, and new issues have also emerged. Perhaps the most difficult question is whether or not disabled people are "entitled" to access to buildings and other facilities regardless of cost, practicability and other factors. Some would argue that it is wrong even to question whether the facilities for disabled people are "worthwhile", since they should be provided in any case. Decisions concerning disabled people are often clouded by sentiment or are made for emotive reasons and any attempt to evaluate such decisions is often met with a suspicious fear that the results of the evaluation will be a policy reversal. However, in a world of scarce resources, any investment in, or commitment to, a policy will involve opportunity cost so that an impartial assessment of the effectiveness of, for example, the facilities for disabled people on Metro is essential. The aim of this thesis is to present just such an assessment.

# CHAPTER 2 :

# THE TYNE AND WEAR METRO

# AND ITS DEVELOPMENT

## 2.1 Brief Description of the Tyne and Wear Metro

The Tyne and Wear Metro (see Figure 2.1) is a modern, light rapid transit system intended to provide the core of an integrated public transport network for the Tyne and Wear area. At present, Metro comprises 34 route miles of mostly double track with 44 stations, and was opened in stages as follows:

| | | |
|---|---|---|
| Haymarket - Tynemouth | : | August, 1980 |
| South Gosforth - Bank Foot | : | May, 1981 |
| Haymarket - Heworth | : | November, 1981 |
| St James - Tynemouth | : | November, 1982 |
| Heworth - South Shields | : | March, 1984 |

Much of the system uses the alignment of old British Rail suburban lines, chiefly what was known as the North Tyne Loop and also the South Shields Branch Line. Eight new miles of mainly underground track provide direct links between the hitherto poorly-connected suburban lines to the north and south of the Tyne and also give greatly improved penetration of Newcastle City Centre. Metro crosses the Tyne via a new bridge and there is also a new viaduct across the Ouseburn Valley between Manors and Byker Stations. Six Metro/bus interchanges have been constructed, at Regent Centre, Four Lane Ends, Gateshead, Wallsend, Heworth and Chichester. There are also seven underground stations, namely: Gateshead (which is also an interchange), Central Station, Monument, Haymarket, Jesmond, St James and Manors, while the remaining 32 stations, at or near surface level, are classified as suburban stations. Of the latter, 22 are of entirely new construction while the remaining 10 are former British Rail stations of varying ages and degrees of modernisation.

As far as possible, the design and layout of stations have been standardised with an emphasis on a bright, airy appearance and all equipment is vandal-resistant. All stations are normally unmanned; single and transfer tickets can be purchased from self-service machines while transfer tickets are also issued on some bus services. Season tickets, known as Travelcards, are also available. Passengers enter the system either through turnstile barriers or (with a special pass) through a wider gate-type barrier for wheelchair users, people with prams and pushchairs, and others requiring wider access.

Each of the four Metrolines has a 10-minute frequency, so that the heavily-used North-South section through the centre of Newcastle has a train every three to four minutes in each direction. Rolling stock comprises a fleet of 88 articulated Metrocars, 27.8m long, 2.7m wide and 3.2m high, with a seating capacity of 84 and a crush capacity of 272 passengers. Metrocars have four sets of double doors on each side, which are opened by passengers but closed by the driver, a warning tone being sounded prior to door closure. Doors have sensitive edges and will re-open again if any obstruction is encountered. The door mechanism is interlocked with the power control so that the train cannot move unless all the doors are properly closed. Trains are single-manned and normally comprise two Metrocars.

## 2.2 Facilities for disabled people on Metro

A publicity leaflet produced by Tyne and Wear PTE (1981) states that "Special facilities to help the handicapped traveller have been designed into the [Metro] system." Attention is drawn in the leaflet to the main facilities for disabled people on the Metro, comprising:

i) wide entry and exit gate-type barriers for wheelchair users and others requiring such a facility;

ii) ramped approach paths and overbridges at "surface" stations;

iii) lifts at underground and interchange stations;

iv) information telephones at key stations and in lifts linked to the South Gosforth Control Centre;

v) narrow gaps and level entry/exit between platform edges and Metrocars;

vi) wide doors on Metrocars;

vii) textured and/or raised platform edges for visually impaired users;

viii) A Concessionary Travel Permit Scheme allowing free off-peak travel for old age pensioners and disabled people.

In addition, many minor features, such as handrails, have been designed with disabled people in mind. A report published by Tyne and Wear PTE (1986) gives the total cost of facilities for disabled people as £4 million out of a total system cost of £179 million (both these figures are at 1975 prices). These sums can be updated by using the annual inflation rates given by the Central Statistical Office (1986), according to which the cost of facilities for disabled people in 1986 prices was some £11 million out of a total system cost of nearly £496 million. While a 75% Infrastructure Grant was awarded by the Department of Transport for the original system construction costs, this did not include facilities for disabled people, which were financed entirely by Tyne and Wear County Council. Appendix I gives plans and a description of each station, including the facilities for disabled people.

Reference has been made above to the Concessionary Travel Permit Scheme. The following general classes of people are eligible for a Permit : those in receipt of, or eligible for, a state retirement pension; physically handicapped people; blind people and some partially-sighted people. Permits are available for free travel at off-peak times (currently weekdays 0930-1600 and after 1800, and all day weekends and public holidays), but in certain cases unrestricted Permits, giving free travel at all times, are issued to disabled people in full-time employment or attending sheltered employment or a training centre. Permits, which consist of a travel ticket and a photo-card, are contained in small plastic wallets. To obtain a pass, it is necessary to apply for certification of eligibility from a Social Service Office and then present this to a Tyne and Wear PTE Travelcard Centre. If required, a facility for opening the wide ticket barriers can be included in the magnetically encoded information on the travel ticket. Permits are normally valid for 12 months. A detailed description of the scheme and the current regulations is given in Appendix II, while some of the decisions concerning the scheme are outlined in Section 4 of this Chapter.

## 2.3 Origins of Metro

Metro's origins date back to the White Paper "Public Transport and Traffic", published by the then Ministry of Transport (1967), which included a recommendation that Passenger Transport Authorities (PTAs) be set up to co-ordinate and plan public transport in major provincial conurbations, including Tyneside. The resultant 1968 Transport Act authorised the creation, by the Minister of Transport, of Passenger Transport Areas, in which public transport was to be controlled by a PTA. The main duty of the PTA was "to secure and promote the provision of a properly integrated and efficient system of public passenger transport ....". To this end, the PTA had to produce and implement a Plan for the development of public transport within its area. The operating arm of the PTA was the Passenger Transport Executive (PTE). In accordance with the 1968 Act, control of the former Newcastle and South Shields municipal transport undertakings passed to the new Tyneside PTE on 1st January, 1970. By September of that year, the PTA and the PTE had prepared a Joint Policy Statement which was then published by Tyneside PTA (1970). This noted the PTE's responsibilities with regard to public transport planning and bus operation, as well as the requirement to reach operating and financial agreements with other bus operators in the area and with British Rail. The Statement described local rail services as "financially unsound", since declining usage and lack of clear financial policy had discouraged investment in rolling stock and infrastructure. Doubts were expressed as to the suitability of the existing diesel multiple-unit trains for short-haul suburban operations. In general, the Statement emphasised the lack of interchange with other transport modes and the poor image of the local rail network. Passenger receipts were falling while costs remained high, but emphasis was placed on the value of a system which had its own right of way and was thus free of road traffic congestion.

Meanwhile, all the Local Authorities in the Tyneside-Wearside region together commissioned two firms of consultants, Alan M Vorhees and Associates and Colin Buchanan and Partners, to examine various public transport options for the region. The two firms together produced the Tyne-Wear Plan (1972), which included a description of a possible electric rapid transit system for Tyneside at a cost of about £50 million. Alan M Vorhees and Associates were then commissioned by the PTE and PTA to evaluate the North Tyne Loop, the most heavily used of the local suburban railway lines but which was nevertheless running at a loss. The aim of this study was to determine likely future passenger flows and running costs for five options:

i) To continue present services on the loop;

ii) To increase frequency of service with improved rolling stock, more station car parks and better bus/rail integration;

iii) To reduce services but with more car parks and better bus/rail integration;

iv) To abandon the railway and run more buses;

v) To convert the railway to a reserved road for high-speed bus operation.

Both the Tyne-Wear Plan and the North Tyne Loop Study concluded that some form of electrified LRT system, i.e. a modification of Option (ii) above, would be the most suitable alternative solution, with the least operating deficit. A report of the Tyneside PTE to the PTA on 20th September, 1971 considered the Tyne-Wear Plan and the North Tyne Loop Study, and recommended the conversion of the North Tyne Loop and the South Shields and Bank Foot lines to LRT, with new tunnels across the centre of Newcastle. The PTA agreed these proposals at a meeting on 30th November, 1971. Minutes of this meeting and subsequent PTA meetings referred to below were not published but were held in the former Tyne and Wear County Council's Record Office.

A 75% Department of Transport Infrastructure Grant was sought and approved and the Tyneside Metropolitan Railway Bill was drawn up to give the PTA the necessary powers to build Metro. The Bill received Royal Assent in August, 1973 and construction work began soon after. A detailed description of the various stages of construction of Metro is outside the scope of this thesis and in any event is available from other sources, but one further major development should be mentioned. In late 1975, due to the prevailing economic crisis, the Government imposed a moratorium on the letting of new contracts on all transport capital projects, including Metro. The same firm of consultants (by this time renamed Martin and Vorhees Associates) who had produced the Tyne-Wear Plan and the North Tyne Loop Study were asked to assist in a re-evaluation of the whole Metro system. As a result of this re-evaluation a "Metro Regime" was imposed, limiting revenue support from Central Government to Metro. This expenditure limit included the 75% Infrastructure Grant, mentioned in Chapter 1, which had already been awarded. However, as already stated, the Infrastructure Grant did not cover the additional cost of facilities for disabled people and further grants were ruled out by the "Metro Regime" restriction.

Consequently, Tyne and Wear County Council met the entire cost of facilities for disabled people out of reallocation of their own funds.

## 2.4 The development of access for disabled people

Although public awareness of the needs of disabled people was increasing in the 1960s and 1970s, few major initiatives had been taken in the UK concerning access for disabled people to public transport. At the time Metro was being planned, the concept that disabled people had a right to use buildings and facilities, including transport, on the same basis as the rest of the population, had been gaining ground in the United States but was less widely accepted in Britain. Consequently, the idea that disabled people should have more or less equal access to a system such as Metro was entirely novel, so that mistakes and lack of understanding of the problem were inevitable. In fact, the facilities for disabled people on Metro developed in a somewhat haphazard way, largely as a response to pressure from external sources. No facilities for disabled people were included in the original plans for Metro, but within a short time, it was envisaged that some kind of provision should be made at major stations. This policy of partial access for disabled people gradually disappeared: as the plans for each station were reconsidered, changes were made on a piecemeal basis so that, eventually, facilities for disabled people were provided throughout the system. The narrative account below is intended to give a description of the way in which the various decisions concerning access for disabled people evolved. With hindsight, it is all too easy to criticise individuals and policies without remembering the difficulties and uncertainties prevailing at the time. However, a number of shortcomings do emerge, as will be shown. Firstly, there was never any attempt to carry out a thorough appraisal of the investment which was to be made in the facilities for disabled people. This was in part due to the fact that no accurate figures could be obtained of the numbers of disabled people likely to use the system if provision was made for them. Secondly, there was a conspicuous lack of initiative on this matter from Central Government. Apart from the circular entitled "The Disabled Traveller on Public Transport" issued by the Department of Transport (1973), there were no official guidelines regarding disabled people and public transport. Moreover, although a second Infrastructure Grant to cover the additional cost of facilities for disabled people was sought, the Department of Transport rejected this application so that Tyne and Wear County Council were forced to meet the entire cost of these facilities from their own funds. Thirdly, it must be admitted that, initially, there was very little consultation between Tyne and Wear County Council, Tyne and Wear PTE and their predecessors on the one hand and local groups representing disabled people, on the other. As a result, pressure groups could only respond to policy statements with a succession of criticisms until eventually some measure of consultation was instituted. While it is true that some of the points raised by groups representing disabled people were somewhat impractical, there can be no doubt that much goodwill was lost in the early stages by a lack of consultation. Moreover, such consultation would probably have resulted in better provision for disabled people on Metro.

The question of access for elderly and disabled people to the new rapid transit system was first raised in 1973 during the House of Lords debate on the Tyneside Metropolitan Railway Bill. Lord Somers and Lord Moyne both voiced concern as to whether elderly and disabled people would be able to use the new system, while Lady

MacLeod of Borve later expressed similar views. As a result, Dr T M Ridley, then Director-General of Tyneside PTE, wrote to Lord Listowel, the Lord Chairman of Committees, on 6th August, 1973 (see Appendix III). Dr Ridley's aim was probably as much to ensure the safe passage of the Bill as to make any definitive statement of intent regarding the planned facilities for disabled people, but he did comment that plans had already been made to provide lifts at underground stations and ramps at new surface stations. The exact nature of the "discussion ... with local authorities and other organisations" remains obscure. Dr Ridley concluded by expressing the hope that an additional Infrastructure Grant would be made to cover the extra cost of these facilities.

Following Dr Ridley's letter, a report was compiled by the PTE and submitted to a PTA meeting on 24th September, 1973 (see Appendix IV). The PTE were evidently anxious to dispel allegations of insensitivity to the needs of elderly and disabled people and also to discuss the implications of Dr Ridley's letter, the text of which was in fact attached as an appendix to the report. No firm conclusions were reached although several points emerged quite clearly:

i) At some point in the past, the intention had been to provide ramps at new stations but not to instal lifts at underground stations, and the original Infrastructure Grant application had included an item to cover the cost of this provision;

ii) The House of Lords debate, Dr Ridley's letter and recent pressure at local level from groups representing elderly and disabled people had forced the PTE to re-examine their previous policy, so that provision for disabled people would now be made at underground stations;

iii) Under the terms of the 1970 Chronically Sick and Disabled Persons Act, buildings and facilities were required to incorporate provision for disabled people where practicable and reasonable, while a recent circular from the Department of Transport (1973) gave recommendations concerning disabled people and public transport. In the light of these, it was expected that an additional Infrastructure Grant, to meet the cost of new provisions for disabled people, would be forthcoming. This extra cost was estimated to be £500,000. It was also hoped that Local Authority Social Services Departments in the areas served by Metro might make contributions;

iv) Considerations of safety and operational requirements were also seen as important, but no details were given.

The PTA meeting of 24th September also discussed the minutes of a meeting of the South Tyneside Transport Advisory Committee which had been held some two weeks previously. According to these minutes, an undertaking had been given by the PTE that "it would do all that it could, within physical and financial constraints, to incorporate as many facilities as possible for the disabled into the Rapid Transit System." A policy had thus evolved, on a somewhat haphazard basis, of making provision more or less throughout the system. However, there is little evidence to show that the implications of this change of heart were properly understood.

The Local Government changes of 1974 included the creation of the Metropolitan County of Tyne and Wear, covering most of the old Tyneside PTA area plus Sunderland and its environs. As a result, the new Tyne and Wear County Council became the Passenger Transport Authority while the Executive was renamed the Tyne and Wear PTE, with an enlarged operating area. Most matters at County Council level were now dealt with initially by the Tyne and Wear County Council Transport Committee (later the Public Transport Committee). The minutes of these meetings, as quoted below, were held in unpublished form by the former Tyne and Wear County Council's Record Office.

Rumours concerning lack of access for disabled people to the new system were still circulating, and at the Transport Committee meeting on 7th February, 1974, one member drew attention to "reports that lifts would not be installed in two Rapid Transit Stations" but did not, unfortunately, name the stations in question or the source of these reports. Dr Ridley replied that provision for disabled people had been made and a further report would soon appear, which would detail the facilities to be provided and the costs thereof. This report was presented in draft form a few weeks later in March, 1974, while a second and more lengthy report, produced jointly by the PTE and the Metro Management Team, appeared in May, 1974.

The draft report again drew attention to the 1970 Chronically Sick and Disabled Persons' Act and the circular from the Department of Transport (1973). In general, the report's tone was one of great caution and despite previous undertakings to the contrary, access for disabled people to all stations was still not envisaged. Three main topics were discussed: the requirements of disabled people; operational and safety considerations; and the intended facilities at specific stations.

i) Discussions had taken place with Newcastle City Council Social Services Department concerning the number of disabled potential users of the planned system. From these discussions it was estimated that 7% of the City population were disabled, but not all of these were thought to need public transport. Heroic assumptions produced a potential "market" of some 2,500 disabled people in Tyne and Wear who would require special facilities including lifts;

ii) It was intended that trains would be one-person-operated, stations would be unstaffed and dwell times at stops would probably be 20 seconds or less. Doubts were expressed as to the safety of disabled people in crowds and to the question of whether disabled people themselves would wish to use the system when it was crowded. The report claimed that "Metro systems were not ideally suited to use by the disabled" and commented that "for safety reasons within the system, wheelchair users will have to be accompanied by a responsible adult";

iii) Lift provision was accordingly proposed for Haymarket, Monument, Central Station and Gateshead but not at the three other underground stations, Manors, Jesmond and St James. Provision of lift access at Manors was ruled out on the grounds that pedestrian access to and from the station, especially via the pedestrian overbridge to Pilgrim Street, would create difficulties for a disabled person in any case. Similar factors were thought to apply at Jesmond, while it was argued that it would be "irresponsible" to allow disabled people to use St James when soccer crowds were present and usage at other times would be minimal.

The PTE were still very unsure of themselves on the question of disabled people and while some of their concern for safety was understandable, there was no indication that the real needs and views of disabled people had been taken into account. A Department of Transport Infrastructure Grant was still expected regarding the extra expenditure, which was now said to be about £1.1 million.

In May, 1974, the second of the two reports commissioned in February was produced. This document had been prepared jointly by the PTE and the Metro Management Team and was a much more wide-ranging study. After the customary references to the 1970 Chronically Sick and Disabled Persons' Act, it was claimed that 5% of the local population would be unable to use escalators or stairs. This included disabled and elderly people as well as those with luggage, shopping, prams and children. The possibility of alternative provision for disabled people through increased use of cars and dial-a-ride taxi and minibus services was mentioned. However, while these options were worth exploring the report stated that "the public transport system should be made available to as many disabled persons as possible, compatible with safety, technical feasibility, environmental acceptability and cost." Once again, it was thought that problems would arise mainly from close train headways, short dwell times at stations and the question of the safety of disabled people in crowds. The fullest provision for disabled people was thought to require facilities and present difficulties as follows:

i) Lifts should be provided at all major underground and interchange stations, i.e. Haymarket, Monument, Central Station, Gateshead, Regent Centre, Four Lane Ends and Heworth, but not Manors, St James or Jesmond. Ramps with a maximum gradient of 1 in 15 should be installed at all surface stations. The design and location of lifts and ramps would have to be reconciled with environmental considerations, station layouts and passenger flows. Lifts would probably be prone to vandalism. It was estimated that the total cost of all these facilities would be about £1.6 million, about £500,000 more than the sum given in the draft report in March;

ii) Ticketing facilities for disabled people would be required at all stations, but these should not allow other passengers to enter the system without paying;

iii) Near-level entry from platforms to trains was seen as essential, but not difficult to achieve;

iv) Porters might have to be employed at stations to assist disabled people, but this would incur considerably higher labour costs;

v) At-grade track crossings could be installed, subject to the approval of the Railway Inspectorate.

The County Council were asked for an early decision over whether to adopt the recommendations on lift provision at the four main underground stations, i.e. Haymarket, Monument, Central Station and Gateshead. A final decision on Manors, St James and Jesmond was seen as less urgent and it was suggested that a Working Party be set up to investigate this matter. It was felt that decisions regarding the other stations could be deferred. These recommendations were approved by the Transport Committee at a meeting on 16th May, 1974 and in addition to the Working Party (which was to study the design of Manors, St James and Jesmond stations) it was decided that a Members' Panel, consisting of four members of the Transport Committee and four from the Environment Committee, should be set up. This Panel was given the task of investigating the whole question of access for disabled people to public transport, with particular reference to Metro. As well as submitting a report on their findings, the Panel remained in existence for some years and exerted considerable influence on the facilities for disabled people at most stations.

Meanwhile, pressure from disabled people's groups was being exerted upon the PTE. At a meeting of the Newcastle upon Tyne Transport Advisory Committee on 8th January, 1975 (the minutes of which were sent to the County Council Transport Committee), Mr G D S Goddard, then Senior Planner, Tyne and Wear PTE, presented a paper on "Provision for the Disabled on Public Transport". Access to the Metro naturally comprised a substantial section of this document. The paper referred to the Members' Panel and described Metro as being potentially more useful to disabled people than were existing buses. However, a number of potential difficulties were raised:

i) <u>Access from origin to station and station to destination</u>

Since disabled people's ability to walk and/or use buses was restricted, and the facilities provided at Metro stations did not overcome these difficulties, the paper suggested that some Metro stations would thus be inaccessible to disabled people in any event.

ii) <u>Movement between concourse and platform level</u>

Lifts and/or ramps were seen as essential but lift provision at unstaffed stations was considered undesirable because of problems of vandalism. Even if staff were provided, they would not be able to assist except in cases of emergency. Lift operating and maintenance costs might be substantial and the report argued that these should not be met out of normal Metro budgets. The paper hinted that not all surface stations would have ramp access.

iii) Movement within stations and entry to trains

Doubts were expressed as to the safety of disabled people in crowds. A dwell time at stations of 20 seconds in the central area was envisaged, but it was thought that disabled people might require an extra 10 seconds, which "could throw the operating schedules into confusion". Moreover, stations would be unmanned and disabled people could therefore expect no help from porters.

In conclusion, mention was made of the facilities for disabled people on BART in San Francisco and the Stockholm Underground which, it was claimed, were little-used but heavily vandalised. When compared to the reports which had already appeared, Mr Goddard's paper represented a reversal of policy in several important areas, although previous documents had really only been for internal use among the PTE and County Council. In essence, the paper seemed to shrink back from the trend towards facilities for disabled people at all stations by casting doubt upon the desirability and usefulness of such a policy. A rather negative tone had been set by what amounted to the first major public statement for some time concerning the official PTE attitude towards access for disabled people to Metro.

Adverse reaction from pressure groups was inevitable. A document entitled "A Working Party Report on Provision for the Disabled on Public Transport" was published by the Newcastle upon Tyne Council for the Disabled (1975). This report opened with an expression of concern regarding provision for disabled people on public transport, especially the Metro. Although the Council for the Disabled thought that the Metro could be more suitable for disabled people than were existing trains and buses, they were concerned about the PTE viewpoint, as presented in Mr Goddard's paper. The main recommendations were as follows:

i) Access to stations

The report requested the introduction of a Dial-a-Ride Metro feeder service for disabled people, and also the provision of parking facilities for disabled car users at Metro stations.

ii) Movement within stations

Provision of access at central area stations only was rejected as being of little use, and it was pointed out that lifts and ramps would help other groups, for example, mothers with prams. The idea of unmanned stations was also criticised, as was the possibility of not providing access at some surface stations. It was suggested that advice on station design could be offered.

iii) Entry to Metro vehicles

The assumption that disabled people would mostly travel during rush hours was rejected. It was claimed that short dwell times at stations would also affect other groups, for example, people with shopping, luggage or prams and pushchairs. Longer dwell times were therefore urged. On the question of assistance for severely disabled people, the report pointed out that in most cases, such individuals would usually be accompanied.

In general, the report criticised the PTE attitude that the provision of transport for disabled people was a matter for Local Authority Social Services Departments and other similar organisations. A wide gulf now existed between the official PTE stance and the aspirations of the Council for the Disabled and other pressure groups.

By this time, nearly two years had elapsed since the question of access for disabled people to the planned Metro had been raised in the House of Lords, and no coherent policy had yet emerged. However, despite the pessimistic tone of the paper presented by Mr Goddard, the minutes of successive County Council Transport Committee meetings show that, little by little, the principle slowly evolved that facilities for disabled people should be provided throughout the system. By May, 1975 the designs of Byker, Chichester and Tyne Dock stations had been approved by the Transport Committee. These designs included the provision of ramps at Byker and lifts at Chichester but there were no plans at all for access for disabled people to Tyne Dock. This latter decision was contested by the Members' Panel, who suggested that provision should be made at Tyne Dock for disabled people, even though this would involve moving the proposed station site some six metres southwards, which would conflict with the adjacent National Coal Board railway. Shortly afterwards, the Members' Panel added to the succession of reports and papers on the question of disabled people and Metro by producing their own recommendations. These were as follows:

i) Metro should accommodate ambulant disabled people and be designed accordingly;

ii) Provision should be made wherever possible for accompanied wheelchair users and the Panel should investigate situations where such provision was not considered practicable;

iii) Unaccompanied wheelchair users should not be excluded from the system;

iv) "Small perambulators" should also be allowed on Metro;

v) Further investigations should be undertaken into the number of disabled people in the population as a whole.

The Members' Panel had now set themselves in favour of full access throughout the system for disabled people. Over the next two or three years, the Panel invariably insisted upon the inclusion of facilities for disabled people as successive plans for stations were submitted for approval. It was largely due to the efforts of the Members' Panel that the necessary alterations were made to the design of Tyne Dock in order to allow ramp access to the station and a ramped underpass. Similarly, the Panel advised that facilities for disabled people should also be incorporated into the plans for Shields Road station (renamed Chillingham Road prior to opening). It was anticipated that the majority of passengers using Shields Road would be employees at the adjacent C.A. Parsons works, so that only a very few disabled people were expected. This shows that the Panel were now advocating facilities for disabled people as a matter of principle rather than on the basis of potential usage.

The Consulting Civil Engineers for Metro were Mott, Hay and Anderson and in mid-1975 they were asked to prepare costings for facilities for disabled people at eight stations: Jesmond; Haymarket; Monument; Central Station; Gateshead; St James; Manors; and Old Fold (renamed Gateshead Stadium prior to opening). These costings are summarised in Appendix V. It is clear that the decision not to instal lifts at Manors, Jesmond and St James had been overturned and the full implications of making provision for disabled people were now being studied. By far the most expensive station was Monument: the installation of two lifts involved a good deal of extra work with a total cost of £338,000 in 1975 prices. This was more than three times the cost of the next most expensive alterations, which were at Haymarket, where the cost of providing one lift was anticipated to be about £108,000. All but one of the eight stations listed were to have lifts, the exception being Old Fold where the construction of ramps was expected to cost a mere £5,000. About six months later, in March, 1976, the Transport Committee were told that the total cost of facilities for disabled people throughout the system was expected to be in the region of £3.1 million at November, 1975 prices. Figure 2.2 gives details of the steadily increasing estimates of the cost of facilities for disabled people. Each estimate is given both in terms of the price at the time of the estimate and also at November, 1975 prices so that the effects of inflation are negated. Considerable differences still remain after inflation has been taken into account. These are due firstly to the fact that the earlier estimates did not envisage facilities at all stations and secondly, it was only in later instances that accurate costings were drawn up. According to Tyne and Wear PTE (1986), the final cost of the facilities for disabled people was £4 million at November, 1975 prices. This figure can be adjusted for inflation according to the information given by the Central Statistical Office (1986) to give an estimated cost at 1986 prices of £11 million.

Yet another PTE report was prepared in September, 1977. This gave a full breakdown of the estimated cost of facilities for disabled people at each station, and included stations both where a firm decision had been reached and those at which the exact facilities for disabled people had not been determined. In the former case, the facilities outlined in the report are largely those which were eventually installed. Items were also included for ticketing facilities and contingencies and the total cost remained at just under £3,100,000 at November, 1975 prices. These costings are given in Appendix VI.

Despite the fact that the PTE and County Council were now committed to providing facilities for disabled people throughout the system, criticism of the plans continued. In June, 1978, a report by Manook et al (1978) was published jointly by Newcastle upon Tyne Council for the Disabled and Newcastle upon Tyne Polytechnic. Entitled "Transport Research Survey : a survey into the needs of disabled and elderly persons in Tyne and Wear", the aim of the study was to investigate the public transport requirements of elderly and disabled people with particular reference to Metro. It is quite clear that the authors and publishers were concerned that the new system, once open, would not incorporate sufficient provision for disabled people so they sought to produce evidence which would persuade the PTE and County Council to re-examine the matter and improve the intended facilities.

The very fact that the report was produced at all shows that the PTE and County Council had not been very effective in communicating their recent deliberations in favour of making all parts of the system accessible to disabled people. Unfortunately, however, the report was flawed in a number of ways which reduced the credibility of the findings. Manook and her colleagues based most of their recommendations on a questionnaire survey of disabled and elderly people, the names and addresses of whom had been obtained from voluntary groups in membership with the Council for the Disabled and from visits to local Day Centres for disabled people. In addition, visits were made to a local bus depot and to the Metro Test Track. A total of 876 questionnaires were distributed to elderly and disabled people, of which 518 (59%) were completed and returned. Sadly, although the authors conceded that this sample was probably biassed, very little attempt was made to overcome this problem.

Perhaps the most striking point to emerge from the questionnaire survey was the widespread lack of knowledge about Metro. The full questionnaire and results are given in Appendix VII. When respondents were asked to comment on whether they thought the opening of Metro would change their travel patterns, 40% replied that they did not know enough about the planned system to give any answer. Similarly, the answers to a series of questions on general aspects of Metro showed that the majority of respondents had very little idea of what Metro would be like. From the survey results and the visits to the Metro test track and mock-ups, Manook and her colleagues arrived at the following conclusions:

i) There had been very little initial concern regarding access for disabled people to Metro, which had only been rectified by the Council for the Disabled;

ii) Planning for future public transport development should include consultation with representatives of all potential user groups, especially disabled people;

iii) Extensive publicity campaigns were required to make disabled people aware of Metro and to encourage them to make full use of the system.

A number of specific recommendations and criticisms were made regarding possible improvements to the facilities for disabled people on Metro. These were as follows:

i) Doubt was expressed as to whether a forward-facing wheelchair would be stable when a Metrocar was accelerating or braking. (This has not been found to cause difficulty unless the wheelchair itself is defective). The restriction of wheelchairs to the door vestibule area was also criticised;

ii) The positioning of the emergency stop button at a height of 6 ft. 6 in., supposedly out of the reach of vandals, but also of 70% of women, was condemned;

iii) It was suggested that a buzzer could be sounded in conjunction with a light, indicating that the doors could be opened;

iv) The reservation or dedication of some seats for disabled and elderly people was also suggested. However, design work on the Metrocars was by then too far advanced for this to be acted upon;

v) The use of contrasting colour schemes was recommended on walls and floors to indicate to partially-sighted people corners and edges to avoid and routes to follow;

vi) It was suggested that Metro maps at stations should include tactile markings, i.e. raised station names etc.;

vii) Handrails should be provided at all stations and be curved into the wall at the ends of staircases rather than stopping abruptly;

viii) Signs at stations should be clearly visible to all, including partially-sighted travellers;

ix) Audible announcements on stations were recommended;

x) It was hoped that ticket machines would be usable by disabled people. In fact, most wheelchair users are unable to reach the coin slot and buttons, but this is largely circumvented by the availability of Concessionary Travel Permits;

xi) The provision of wide ticket barriers for wheelchair users and others was assumed and indeed this provision has been made;

xii) Further investigations should be made into the appropriate angle for raised platform edges;

xiii) A central orientation point ought to be provided on island platforms, together with some means of guiding people towards the expected positions of doors on trains standing at platforms;

xiv) The gap between platform and train was said to be "unacceptably wide". Accidents and other problems of entry and exit were predicted. In the event, average gaps were initially well below stated maxima;

xv) Lift buttons should be of a uniform layout, with embossed rather than engraved lettering;

xvi) The Council "deplored" the fact that facilities for crossing the track at most stations consisted solely of a footbridge. In the event, at-grade crossings were not provided for safety reasons;

xvii) Adequate parking provision for disabled people's cars was recommended and indeed such provision has been made in Metro station car parks;

xviii) The emergency catwalk along the tunnel sides was thought to be too narrow for wheelchairs or stretchers. It was suggested that, by building the catwalk into the tunnel side, the necessary extra width, probably about 4 in., could be achieved. However, this suggestion was not adopted.

As might have been expected, the document produced a prompt response and by Autumn, 1978, PTE reaction had been conveyed to both the Members' Panel and the Transport Committee. The PTE described the report by Manook and her colleagues as superficial and argued that many of the criticisms were misplaced. In particular, the survey undertaken for the report was condemned as being unrepresentative and it was also claimed that the authors had neglected the wider issues of Metro operation such as safety, economy and the requirements of the able-bodied majority. Although Manook and her colleagues did make some valid points, their report did nothing to improve relations between the PTE and the Council for the Disabled.

Meanwhile, the PTE and County Council had been proceeding with their own plans. Most of the remaining station designs, with facilities for disabled people included, were approved during 1978 and attention became focussed upon other matters, including the question of ticketing and Concessionary Permits. As the above narrative shows, some thought had already been given to the problem of how to allow disabled people, especially those in wheelchairs, to enter the system without opening up a way for other passengers to use Metro without paying. There was also the difficulty of reconciling the existing Concessionary Travel Permit Scheme with the ticketing and barrier system envisaged for Metro.

Consequently, in November, 1978, the Transport Committee were told of the PTE's proposals for Concessionary Travel Permits and allied matters. Attention was drawn to the fact that determination of eligibility and issue of Permits had traditionally been the preserve of Local Authority Social Services Departments. However, in order to gain access to the Metro system through the envisaged ticket barriers, Permits would soon need to include a magnetically encoded ticket which would only be issued by machines in the proposed Travelcard Centres. In addition, it had already been decided that, for security reasons, Concessionary Travel Permits would in future need to include photocards which again could only be produced by cameras and issuing equipment in the Travelcard Centres. Although the PTE were anxious that determination of eligibility should still rest with the Local Authority Social Services Departments, they conceded that applicants would in future have to make two journeys to obtain a Concessionary Travel Permit. It was proposed that PTE staff, photocard cameras and other equipment would visit Social Services Departments and issue new-style Permits to existing Permit holders, the cost of this being an estimated £105,000. Thereafter, new applicants would have to make two journeys to obtain a Permit. The cost to the PTE of this arrangement was estimated to be about £14,000 per annum or £9,000 per annum more than existing arrangements.

Although there are sound historical and technical reasons for this division of responsibility between the PTE and Social Services, the arrangement by which two visits have to be made to obtain a new Permit have caused some confusion and even deterred some disabled people from obtaining a Permit and from using the system. No reference was made at this stage to arrangements for entry to Metro for wheelchair users.

However, renewed pressure had come from Mr Dempsey of the Newcastle upon Tyne Council for the Disabled concerning disabled Metro users and the ticketing and barrier system. In addition, a petition, signed by 1,823 North Tyneside residents, was presented to the County Council in protest at the apparent absence of facilities for prams and pushchairs. The PTE therefore undertook to study the question of pram access and produced a report in April, 1980, only four months before the first section of Metro was opened. Apparently, some form of wide ticket barrier was already envisaged as the probable answer to the needs of wheelchair users and the intention was evidently to incorporate a facility for opening the wide barriers into the Concessionary Travel Permit. The main issue discussed by the report centred upon the requirements of other groups of people who were not eligible for a Concessionary Travel Permit but who were likely to benefit from being able to use the wide barriers. Disabled children, temporarily disabled adults, disabled people not resident in Tyne and Wear and people with prams or push-chairs were the main categories under consideration.

The report recommended that such groups be able to purchase a "Key Pass" to open the wide barriers at a price of £1 for three months or £2 for a year. Key Passes would not be valid for travel, however, and holders would therefore also have to purchase tickets for their journeys. The charge for Key Passes was abolished some time after their introduction and the three-month passes have been withdrawn.

Further discussions concerning the Concessionary Travel Permit Scheme prompted the production of a revised "Description of Scheme and Conditions of Issue", which were approved by the Public Transport Committee in July, 1981. The description and conditions are reproduced in Appendix II. In a brief covering report, the PTE stated that the take-up rate of disabled people's Concessionary Travel Permits was rather low and the take-up rate for Newcastle City was lower than that for other Districts in Tyne and Wear. This discrepancy was explained in a subsequent report which pointed out that disabled people who held a Permit were always transferred (by the City Council Social Services Department) to Old Age Pensioners' Permits upon reaching retirement age. Thus a number of disabled people in Newcastle were recorded simply as old age pensioners. In practical terms, there was no difference in the Permits issued. As regards the overall issue of Permits, it was disclosed that an estimated 20% of the population of Tyne and Wear were eligible for a Concessionary Travel Permit, including both elderly and disabled people, and just over 13% of the County population actually held one. The take-up rate was therefore about 65%.

By mid-1981, Metro was open between Haymarket and Tynemouth and also between South Gosforth and Bank Foot (see Figure 2.1) so there was now the opportunity of carrying out an evaluation of the facilities for disabled people in operation. Accordingly, a report appeared in December of that year by Robinson and Porter (1981) entitled "'Disabled' People and the Tyne and Wear Metro : A Field Evaluation". This investigation is discussed more fully in Chapters 4 and 5 of this thesis. There were five sections in the report of which the first three were mainly introductory, giving details of Metro and its development as well as a very brief outline of the needs of disabled people on public transport. The main purpose of the study, to evaluate the system from a disabled person's point of view, was described in section 4 of the report. Numerous voluntary groups for disabled people had been approached in an effort to obtain opinions of Metro from disabled people and also to recruit volunteers to visit stations and travel on the system. Although some evidence was collected, only 23 volunteers eventually came forward.

Despite this setback, a great deal of effort was put into section 5, the largest section of the report, which contained the results of the visits. Detailed plans of each station were given, together with comments from the volunteers and the section concluded with a series of comments and recommendations. The latter are given in Appendix VIII of this thesis (together with the PTE's response) while Chapter 5 contains analysis of the report's findings. The PTE response was originally given in a PTE report submitted to the County Council Metro Construction Sub-Committee meeting of 10th May, 1982. Although the PTE suggested that areas of low-cost improvement should be investigated, the Polytechnic survey was criticised because of the small sample. Any major alterations were rejected on grounds of cost. The County Council Public Transport Committee meeting of 17th June, 1982 also officially received a copy of the Polytechnic Study and requested the PTE to investigate areas of low-cost improvement as part of the routine repair and maintenance programme.

The Polytechnic Study was on the whole not well received by the PTE and indeed it is flawed in some respects. Although the very small number of volunteers was probably not due to any failure on the part of the Polytechnic, attention was not drawn to the fact that the recommendations in section 5 may well have been derived from the comments of only one or two individuals. In addition, the general tone of the report was rather negative and the volunteers were asked to report any difficulties they experienced. This clearly was a biassed question and it would have been far better to ask for comments on specific aspects of the system rather than comment on difficulties. As a result, the recommendations appear to be a list of cricitisms without any remarks as to which aspects of the system the volunteers liked or found helpful. Undoubtedly, the PTE were sensitive about such a critical report appearing so soon after Metro had opened and the very newness of the system militated against any large-scale alterations. In the event, few of the low-cost recommendations have been adopted although some problems, such as the alleged tendency of Metro drivers to overshoot or stop short of platforms, have largely disappeared over time.

The final item of archive material relating to access for disabled people to Metro is a draft of a report dated 18th June, 1982 giving details of a recent survey of entries to Metro through the wide barriers. In the event, the report was never formally presented to the Public Transport Committee. However, the information contained therein is of interest and the main points are:

i) There were 209,500 Concessionary Travel Permits in circulation at the time and 3,500 Barrier Keys;

ii) 688 entries to the system were made daily through the wide barriers. This represented 0.6% of the then total daily system boarding of 119,250. The 688 wide barrier users comprised:

600 people with prams/pushchairs,
42 blind people,
46 wheelchair users.

No mention was made of the method of data collection, or whether the figures represented counts from a few stations on part of a working day or an average of several days, although this seems unlikely. If counts were indeed made on one day only then their statistical significance must be somewhat doubtful.

In spite of their limitations, some use can be made of these statistics. Other counts of wide barrier use confirm the fact that there are several times more people with prams and pushchairs than disabled people using the wide barriers. It was stated in the report that "no significant patterns of use emerge to indicate that any station poses a particular deterrent to blind users." None of the blind people observed were said to have had any special problems:

all were unescorted though 17 of the 42 had guide dogs. Of the 46 wheelchair users, 16 were unescorted while the remaining 30 were seen to be accompanied. In conclusion, the report promised that further monitoring of wide barrier use would take place and that the results would be circulated to Public Transport Committee members, but it is not clear how many further counts were made. The results of two surveys of lift use have been made available to the writer, and these have tended to confirm the findings of the wide barrier counts.

## 2.5 Conclusions

The above history of the development of access for disabled people to Metro shows that decisions were not taken together, but on an ad hoc basis. An overall concept of a totally accessible system did not emerge until relatively late in the design process. The uncertainty surrounding this matter was the cause of some concern among local disabled people's groups, and there appears to have been the feeling that no facilities at all would have been provided had not pressure been brought to bear on the PTE. It is certainly unfair to accuse the County Council of insensitivity, since they spent £11 million on facilities for disabled people on Metro, in the absence of any grant aid from Central Government. However, as mentioned at the start of the previous Section, it does emerge that this £11 million was largely spent without any definite appraisal of the likely benefits of this expenditure. The policy of making Metro accessible to disabled people was in fact not so much a deliberate policy but a series of disjointed responses to external pressure.

With the benefit of hindsight, it is very easy to point out the steps that should have been taken. When originally confronted with the issue of access for disabled people to the planned Metro system, the then Tyneside PTE should ideally have commissioned a study of the facilities which would be required, with the aim of taking evidence from professional experts and from disabled people and their representatives. A clear picture would then have emerged of the necessary expenditure and a social cost-benefit analysis could have been undertaken. It is all too easy to criticise those responsible for not having carried out such an exercise and in their defence it may be noted that issues concerning disabled people tend to be very emotive. Any policy which appears to evaluate facilities for disabled people on grounds of costs and benefits is likely to be seen as putting a price on disability. However, it is important to remember that an accurate evaluation of investment decisions is all the more important when financial resources are limited. According to the economic evaluation in Chapter 6 of this thesis, the investment in facilities for disabled people on Metro can be justified on the grounds that social benefits outweigh the costs, but this might not have been the case. Having considered the way in which the facilities for disabled people on Metro came into being, the next Chapter will investigate various surveys of the size of the disabled population in order to estimate the likely number of disabled Metro users.

Figures - Chapter 2

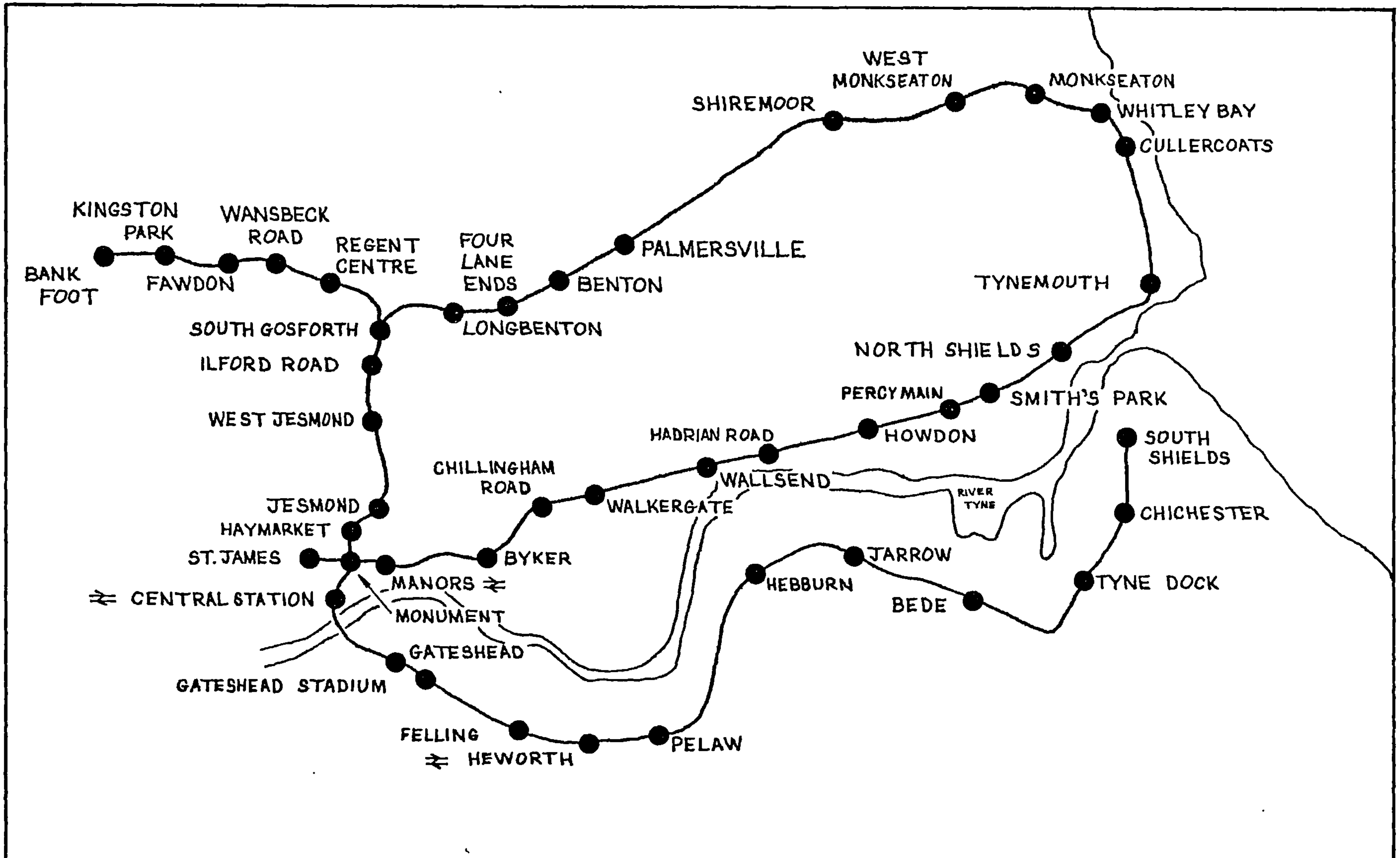



FIGURE 2.1: METRO SYSTEM 1987

Figure 2.2 : Increases in the estimated cost of facilities for disabled people on Metro, 1973-86

| Date of estimate | Cost at contemporary prices | Cost at Nov.1975 prices |
|---|---|---|
| | £ | £ |
| September 1973 | 500,000 | 720,000 |
| March 1974 | 1,100,000 | 1,600,000 |
| May 1974 | 1,600,000 | 2,300,000 |
| March 1976 | - | 3,100,000 |
| September 1977 | - | 3,100,000 |
| 1986 | 11,000,000 | 4,000,000 |

Notes:

1) The March, 1976 and September, 1977 estimates were only given in terms of November, 1975 prices.

2) The 1986 estimates are those given by Tyne and Wear PTE (1986).

3) Allowance for inflation was made according to the annual inflation rates given by the Central Statistical Office (1986).

# CHAPTER 3 :

# NUMBERS AND CATEGORIES

# OF DISABLED PEOPLE

## 3.1 Definition of Terms

"Disabled", "handicapped", "impaired" and other descriptions are often used interchangeably, without any attempt at precise definition. Some expressions such as "invalid" and "cripple" are now regarded as unacceptable while the term "the disabled" has been replaced by "disabled people" or "people with disabilities", but all these tend similarly to be used without any clear indication of what they really mean. Moreover, North American usage and definition can differ greatly from British parlance. In Britain, the traditionally accepted definitions are those given by Harris (1971) in "Handicapped and Impaired in Great Britain". This study was conducted by the Office of Population Censuses and Surveys on behalf of the Department of Health and Social Security, the Scottish Home and Health Department and the Welsh Office and until recently was the most comprehensive study of its kind in Britain. The three terms used in the report - impairment, disablement and handicap - are defined as follows:

| | | |
|---|---|---|
| Impairment | : | "lacking part or all of a limb, or having defective limb, organ or mechanism of the body". |
| Disablement | : | "the loss or reduction of functional ability". |
| Handicap | : | "the disadvantage or restriction of activity caused by disability". |

These definitions were taken by Harris from an article by Jefferys et al (1969) in a contemporary medical journal. They draw attention to the very important point that for different individuals, the consequence of an identical physical problem can differ greatly and Harris gives a hypothetical example of two people, each of whom has had a leg amputated. Their impairment, i.e. loss of a leg, and disability, i.e. reduction of locomotive ability, are identical. However, if one person has a supportive spouse, an adapted car and a sedentary job while the other lives alone in a second-floor flat with no lift, has no car and, prior to losing a leg, had a job involving a considerable amount of standing and walking, their degree of handicap is not identical. The first individual would not be as severely handicapped as the second, whose impairment would probably result in loss of employment, a significant reduction in outdoor mobility and problems with self-care in the home. A much less serious impairment, the loss of a finger, would result in considerable handicap for a concert pianist but the majority of people would not think of themselves as being seriously handicapped by this degree of impairment. As the title implies, the aim of the Harris study was to examine the number of impaired people in Britain and "to assess .... to what extent those with physical, mental or sensory impairments are handicapped."

Harris tends to avoid using the word "disabled" but more recently, the terms "disabled people" or "people with disabilities" are generally used where Harris would have referred to "impaired" people. Consequently, this thesis will refer to "disabled people" when dealing with people who, to some extent, suffer a reduction or loss of functional ability because of loss of or defect in an organ or mechanism of the body. This is something of a composite of Harris's definitions of impaired and disabled. However, the definition of handicap used by Harris, i.e. "the disadvantage or restriction of ability caused by disability", will be retained, as this thesis will seek, among other objectives, to establish the extent to which the facilities for disabled people on Metro actually affect their degree of handicap.

In its widest sense, the term disabled people includes groups not taken into consideration when the facilities on Metro were being debated. Documents relating to this subject show that the facilities on Metro were designed almost solely to cater for visually impaired people and those with physical problems which restrict mobility. Mentally handicapped people and deaf people are therefore among the groups not specifically provided for on Metro, but who would be included in any general survey of disabled people. The intention of this thesis is to evaluate the facilities currently provided on Metro for disabled people, and so, although some recommendations for improvement will be made, it would seem to be outside the scope of this thesis to suggest the kind of facilities required by groups of people not originally considered when the existing level of provision was being planned.

For the sake of brevity, in this thesis, the term disabled people will in subsequent chapters (unless otherwise stated) therefore only include visually impaired people and people with physical disabilities restricting mobility.

Some publications, notably those from North American sources, introduce the concept of Transportation Handicapped, or TH, people: this refers to those people whose disability causes handicap specifically when using conventional public transport. This somewhat cumbersome definition will be avoided, again on the grounds that as the question of provision of facilities on Metro developed, the major target groups of disabled people under consideration were those stated above. This thesis will largely be concerned with these two groups of people, and others with disabilities which render them Transportation Handicapped will be considered only in passing. No doubt the representatives of, for example, deaf or mentally handicapped people may feel that provision should have been made on Metro for those with such problems, and that this thesis should point out this omission. However, as the main objective is to evaluate the design and cost-effectiveness of the facilities currently provided, any remarks on omissions made or improvements required must be of peripheral interest.

## 3.2 Surveys of disabled people : an overview

On the basis of the definitions given in the previous Section, it is generally accepted that upwards of 7% of the current UK population of approximately 55 million are disabled - in other words, about four million people. This implies that the current population of the Tyne and Wear area (approximately 1.14 million) includes 80,000 or more disabled people. More precise estimates will be given in later Sections of this Chapter. The first attempt to gain some idea of the numbers and characteristics of disabled people in the UK was made in the 1948 National Assistance Act. This included sections which compelled Local Authorities to set up registers of deaf, blind and other "substantially and permanently" disabled people and which also gave Local Authorities the power to provide services for such individuals if a need existed. The Act had two main drawbacks: firstly, the onus was on disabled people to come forward and register themselves rather than on Local Authorities to seek them out and secondly, Local Authorities were empowered but not required to provide services for disabled people. Growing unease over widely differing levels of service provision in different areas and doubts regarding the accuracy of the Local Authorities' registers led eventually to the 1970 Chronically Sick and Disabled Persons' Act. Section One of this Act compelled Local Authorities to inform themselves of the number of substantially and permanently disabled people in their area and to find out the kind of services required, while Section Two made the provision of such services compulsory. Shortly after the Act became law, the results of the study entitled "Handicapped and Impaired in Great Britain" by Harris (1971) were published. The fieldwork for this survey was carried out prior to the passing of the 1970 Act and

Harris's findings tended to confirm the suspicions of those who had campaigned for the Act. Harris found that, on average, about 20% of severely disabled people and only about 3% of moderately disabled people were registered with their Local Authority and there was little correlation between registration and receipt of services from the same Local Authority.

Newcastle upon Tyne City Council were one of the first Local Authorities to instigate a survey of disabled people in compliance with the terms of the 1970 Act and a two-volume report on this survey was published two years later by the City of Newcastle upon Tyne (1972). A similar survey was conducted in 1983 by the City Council and the District Health Authority to provide updated information on the numbers and needs of disabled people and to enable a comparison to be made with the 1972 survey. The final report was also published by the City of Newcastle upon Tyne (1985) and the results of this survey are analysed in Section 4 of this Chapter. Section 5 of this Chapter contains data from a similar survey, conducted in the Metropolitan Borough of North Tyneside, another of the five Local Authorities which comprise the Tyne and Wear area (see map, Figure 3.1). This survey was carried out in 1980/81 by the Borough Council Social Services Department in conjunction with OUTSET, a registered charity set up in 1970 to assist Local Authorities with surveys of disabled people. The report on this survey was published by North Tyneside (1982). The University of Newcastle upon Tyne subsequently obtained from North Tyneside Social Services a list of wheelchair users identified by this survey who were willing to participate in a further investigation, conducted by the University, into the characteristics of wheelchair users in connection with a project aimed at monitoring the trials of the prototype CR6 taxi, a new design of taxicab intended to accommodate people in wheelchairs. Section 6 of this Chapter gives information on the findings of this survey.

Further information concerning the number of disabled people in the Tyne and Wear area can be obtained from the Tyne and Wear Public Transport Impact Study (PTIS) data. The PTIS comprised a series of surveys which were intended to assess the effect of the introduction of Metro. A number of "before" surveys were carried out and were to have been followed by comparable "after" surveys, although the latter have largely been scrapped. Respondents were asked to state whether they had particular mobility problems and there are other indications as to the number of respondents who were disabled. The results are given in Section 7 of this Chapter.

## 3.3 The Study by Harris (1971)

As already mentioned, the report by Harris (1971) entitled "Handicapped and Impaired in Great Britain" remained, until recently, the most comprehensive national investigation ever conducted of the numbers, characteristics and needs of disabled people. However, a similar study was carried out in 1985 by the Department of Health and Social Security in conjunction with the Office of Population Censuses and Surveys. The results were due to be published in late 1987. As well as being concerned with the production of a reliable estimate of the number of disabled people aged over 16 living in private households in Great Britain, the Harris study was also intended to give indications of the main causes of disability, the effects of disability on self-care and of the level of help given by Local Authorities and voluntary bodies. Additional information, not relevant to this thesis, was given on the housing conditions of disabled people, the effect of disability on employment and social life and the extent to which disabled housewives were able to perform their tasks. This Section will give details of Harris's findings only insofar as they bear upon the present thesis.

For the first stage of data collection, a random nationwide sample of 250,000 households was chosen. About 100,000 of these (known as Sample A) were sent a brief questionnaire form plus a covering letter asking whether there was anyone in the household who lacked all or part of any limb or who had difficulty with any of a given list of basic self-care tasks. Since it was expected that the number of severely disabled people disclosed by this survey would be relatively small, the remaining 150,000 households (Sample B) were sent a different questionnaire asking whether anyone in the household was bedfast, confined to a chair, housebound or heavily dependent on others for routine care. Thus, Sample A was expected to produce a fairly accurate indication of the numbers of disabled people in the general population while Sample B would yield a number of severely disabled people who would be the subjects of a detailed study. Both questionnaires are reproduced in Appendix IX. 86% of all the questionnaires were completed and returned. Sample A yielded a total of 14,609 disabled people and detailed interviews were sought with about half of these. The interviews comprised an exhaustive questionnaire which sought information on a wide range of subjects including general personal details; nature of disability; the extent of self-care ability; the level of care given by family, friends and outside groups; income, car ownership and housing type; employment record and social life and the problems encountered by disabled housewives. Wheelchair users were asked a number of additional questions. Sample B provided a total of 1,122 severely disabled people of whom nearly 1,000 were interviewed: the same questionnaire plus a supplement was used. All interviewees were also asked to perform a series of small-scale exercises such as grasping pens, cups and other small objects, as well as standing, sitting and walking. Their ability or refusal or inability to perform these tasks was noted. When the smaller number of severely disabled people was weighted and added to the number of interviewees from Sample A, interviews were conducted with the equivalent of 12,738 people. An estimate of the total number of disabled people aged 16 or over living in private households was then arrived at. The total of 14,609 disabled people revealed in Sample A was factored up according to the known total number of people aged 16 or over in private households, i.e. about

39 million, which gave an estimated 3 million disabled people aged 16 or over living in private households in Great Britain. Assuming that the 14,609 disabled people from Sample A are a representative sample of all disabled people aged 16 or over, then a breakdown of the main causes of disability will be as given in Column B of Figure 3.2.

Harris was not concerned with disabled children or with disabled people living in institutions but she estimated that there were about 400,000 of these. Moreover, Harris's survey work was carried out in 1968/69, so the information thus gathered was 17 or 18 years' old at the time this thesis was written, during which time the UK population has risen from approximately 54 million to about 55 million, but since the average age has also increased, the number and percentage of disabled people will increase at a faster rate than the overall population. L B Mullett, in his (as yet) unpublished work "Transport Without Handicap : Practice, Problems and Possibilities", undertaken for the Department of Transport, gives an updated version of Harris's estimates. He calculates that, including disabled children and those living in institutions, the total number of disabled people has probably risen to about 4 million, an increase of over 17%, while the total population has only increased by less than 2%. In percentage terms, about 6.3% of the total 1971 population were disabled, compared to nearly 7.3% at present. Consequently, Column C of Figure 3.2 gives an update of Harris's figures, based on Mullett's estimates. While Figure 3.2 gives the sixteen major disability groupings according to the 1959 International Classification of Diseases, which Harris used, she also gives breakdowns into specific diseases for four of the groupings with the largest numbers of sufferers, i.e. groupings

VI, VII, VIII and XIII. These are also the groupings which comprise most of the disabilities likely to produce mobility problems and thus to be of interest to this thesis. Figures 3.3, 3.4, 3.5 and 3.6 give these breakdowns, again with estimates of the total numbers of sufferers at the time of writing. The updated estimates in these Figures assume that the numbers of people with various diseases, relative to each other, have remained unchanged and that the proportionate numbers of sufferers in institutions and/or aged under 16 are largely the same as sufferers aged 16 or over living in private households. The category with the largest number of sufferers, as shown by Figure 3.2, is the group of diseases of bones and organs of movement. Within this group, Column C of Figure 3.6 shows that, at present, an estimated 1,133,000 people suffer from some form of arthritis and in fact there are more sufferers from arthritis than there are in any of the fifteen major groupings other than diseases of bones and organs of movement. It should be remembered that the figures given in Figure 3.2 exceed the total number of disabled people since some people quoted more than one main cause of disability. Given that a number of those with arthritis will also have other disabilities, about 28% of disabled people suffer from that disease sufficiently badly to cite it as a main cause of disability. This amounts to some 2% of the total population of Great Britain. Moreover, the above figures only give the main cause(s) of disability, so there are almost certainly others with arthritis who suffer from other complaints to a more serious extent. The figures for the number of people with other disabilities will be analysed in Section 4 of this Chapter, in comparison with similar statistics for the population of Newcastle upon Tyne.

The age and sex distribution of the 3 million or so people calculated by Harris to be disabled is given in Figure 3.7. According to Columns B and C, the majority of disabled people are elderly: about 58% are aged over 64 while barely 3% are aged 16-29 and only about 15% are under 50. Columns D and E show that, although more young disabled people are male than female, the majority of elderly disabled people are women. This is probably a reflection of the fact that in the population as a whole, elderly women outnumber elderly men whereas in the younger age groups numbers are more roughly equal. Moreover, the age profile of the disabled population differs greatly from that of the population as a whole. Whereas 58% of disabled people are aged 65 or over and only about 15% are aged between 16 and 49, nearly 59% of the population as a whole are aged between 16 and 49 and only about 16% are aged 65 or over. Harris also showed that the incidence of disability among elderly people is greater than among young people. Barely 1% of all those aged between 16 and 29 are disabled, compared to nearly 38% of those aged 75 or over (in 1971, about 6.3% of the total population were disabled). Taking men and women separately, Harris's results suggest that while the incidence of disability among young men is roughly the same or very slightly higher than among young women, about 42% of women aged 75 or over are disabled, compared to only 32% of men in the same age group. This disparity between the sexes is at least partially due to longer life expectancy among women than men, leading to a higher proportion of extremely elderly women than men.

Other areas of interest to this thesis, in addition to the age and sex distribution of disabled people, are income, household size, car ownership and most important of all, outdoor mobility patterns.

Although Harris gives details of disabled people's incomes, no comparisons with average contemporary income levels are provided and bearing in mind both inflation over the past 17 or 18 years and changes in the structure and scale of welfare benefits, Harris's data are of little use. In any case, more recent information on this topic is available (see Section 7 of this Chapter). As regards household size, Harris found that 21% of all disabled people lived alone while nearly 30% of those aged 65 or over did so. Of those who lived alone, about 13% said they were housebound and a further 8% said they could not go out alone. Perhaps many of those who are housebound and who live alone are housebound only because there is no-one in the house to take them out. Car ownership is another area in which significant changes have taken place since 1968/69 and where more recent statistics are available, so no details will be given here.

Unfortunately, Harris does not give overall mobility levels in terms of the number of trips made per week by disabled people but instead, overall mobility capacity is given and is shown in Figure 3.8. As in the case of Figures 3.2 to 3.6, Column B gives Harris's calculations of those aged 16 or over in private households in 1970 and Column C gives estimates of the total numbers in 1985. This assumes that the mobility characteristics of disabled people under 16 and/or living in institutions are the same as those aged 16 or over in private households. In fact, it is likely that disabled children and those in institutions will have poorer capacity for mobility but this cannot be quantified with available data. Column C of Figure 3.8 shows that at present, about two million disabled people (over half the total number of disabled people) can go out alone without difficulty and do not require an aid to do so. However, this figure is based on questions in the interview survey in which respondents were simply asked whether or not they could go out and, if so, whether they could do so alone, whether they needed to use an aid and whether they had difficulty going out. Respondents were not asked to state the maximum distance they could travel, so it is possible that for some of those who could go out alone without an aid and with no difficulty, this would really only be the case for short trips. Even without this group of people, there remains a core of an additional two million or so people who are unable to go out at all or who can only do so with difficulty or if aided or accompanied. Harris estimated that about 4% of disabled people use a wheelchair, but by no means all of these are wheelchair-bound (she also found a small additional number of people who possess a wheelchair but do not actually use one). About 85% of wheelchair users are able to go out giving a 1971 estimate of 95,000 wheelchair users able to go out: the present-day figure is probably about 124,000.

To sum up, Harris's figures, when updated, suggest that of the present total population of some 55 million:

7.3% are disabled in some way;

1.0% are unable to go out at all;

0.8% can only go out if accompanied;

1.7% can only go out with an aid (including a wheelchair) or with difficulty.

As previously mentioned, the Harris study was not really concerned with the transport needs and problems of disabled people, but amongst the interview questions on leisure activities, respondents were asked whether there was anywhere they would like to go but were unable to get to because of their disability. This rather vague question was intended to cover problems of entry to buildings and other locations once the journey was accomplished as well as any problems in reaching the desired destination. In fact, only 12% of those interviewed said they were not housebound but were prevented by their disability from reaching at least one desired destination. However, a wide range of destinations were specifically mentioned and of the people who replied that they were prevented from reaching desired destinations, 96% said this was due to problems getting there while only 11% said they could not gain entry once there (obviously some respondents specified both problems). However, no further information is given by Harris and the only comment on public transport in the report is a tantalisingly vague remark that "perhaps the most needed developments are those that would enable the disabled to use the public transport system more easily" but there are no details of any specific problems or suggested improvements. Harris therefore gives a good deal of background information on the size of the disabled population and some of its main characteristics. For a more up-to-date picture, and one which gives information on the situation in the Tyne and Wear area, it is necessary to turn to the surveys which are analysed in Sections 4 to 7 of this Chapter.

### 3.4 The Newcastle City Surveys

One of the first reports to be published of a survey of the numbers and needs of disabled people according to the terms of the 1970 Chronically Sick and Disabled Persons' Act, was that produced by the City of Newcastle upon Tyne (1972). A completely new survey was carried out in 1983/84 (but was undertaken in such a way as to enable comparisons to be made with the 1972 survey) and the report was published soon after by the City of Newcastle upon Tyne (1985). In addition to the information contained in the report, much additional data was made available to the author by the courtesy of the City Council Policy Services Unit. According to this latter report, the 1983/84 survey was intended to assess the current and likely future number of disabled people in the City as well as the impact of changes in services and benefits since 1972 and the present characteristics of the disabled population of Newcastle with a view to identifying the major needs for the next ten or so years.

The initial part of the 1983/84 survey consisted of a postal questionnaire which was sent to a random sample of one in nine (roughly 11%) of City households in 1983. A copy of the questionnaire is given in Appendix X. Recipients were asked to state whether anyone in the household was disabled and if so to give details. The form was to be returned even if no household members were disabled. Disability was defined in question 4 as "a physical or mental problem which makes it difficult .... to lead a full life" in relation to work, education, self-care and mobility. At the time of the survey, there were about 106,000 households in Newcastle so the one in nine sample gave nearly 11,800 households from which 1,796 people were identified by the questionnaire as being disabled. These 1,796 people were stratified according to age and sex, and interviews were sought with different proportions of each age/sex group. Eventually, 894 successful interviews were obtained and the results were factored up, using the data from the postal survey, according to the proportion of each age/sex group to the disabled population as a whole, in order to give estimates for all disabled people in Newcastle. From this it was calculated that there were about 20,250 disabled people in the City, or about 7.5% of the total population. This is roughly the same as the figure of 7.3% of the national population indicated by the updated version of Harris's estimates. The incidence of disability in Newcastle is given in Figure 3.9 and this can be compared with Figure 3.2 which gives similar figures for the Harris study. Causes of disability are grouped according to the International Classification of Diseases used by Harris although not all the categories are listed separately in the case of the Newcastle survey. Although the relative numbers of people with various disabilities differ between the two surveys, the overall picture is roughly the same. It should be noted that in the case of the Harris study, respondents were asked to give the main cause(s) of disability while in the Newcastle survey, interviewees were asked to state all their disabilities so that higher percentages of sufferers are to be expected in the Newcastle survey. As in the case of the Harris study, the numbers of people with specific diseases within some of the major groupings are available and are given in Figures 3.10, 3.11, 3.12 and 3.13. Once again, the largest number of sufferers are to be found within Group XIII, Diseases of Bones and Organs of Movement. Within this grouping, 6,650 people, or nearly 33% of disabled people in Newcastle, suffer from arthritis, of which some will have other disabilities and indeed arthritis will not be the major disabling condition in every case.

Against expectations, the overall percentage of disabled people in the City population has not changed greatly. In 1972, it was estimated that about 21,900 or 7.4% of the then population of about 296,000 were disabled while the figures for 1983/84 suggest that about 20,300 or 7.5% of the 270,000 inhabitants are disabled. In other words, the percentage of disabled people has fallen roughly in line with the overall decrease in the City population as more people move to suburban areas. Figure 3.14 gives the numbers and ages of disabled people in Newcastle in 1972 and 1983, which show that the 1983 disabled population has a higher average age than that of 1972. A comparison with Harris's figures in Figure 3.7 show largely the same picture although direct comparisons are rather difficult since most of the age groups are different. Part (ii) of Figure 3.14 shows the number of disabled people in each age group as a percentage of the total City population in that age group and comparisons with Figure 3.7 again show similarities. According to Harris, 58% of disabled people are aged over 65 while about 56% of disabled people in Newcastle are over retirement age, i.e. 60 or 64. In contrast, only 1% or 2% of young people in both cases are disabled. Figure 3.15 shows the sex and age distribution of disabled people in Newcastle and again can be compared with Figure 3.7. Although there is some variation between the two surveys, the trend is largely the same. There are more young disabled men than young disabled women, but the majority of elderly disabled people are women. Overall, about 55% of disabled people in Newcastle are female.

Interviewees were also asked about their take-up of welfare benefits but no attempt was made to gather information on overall household incomes. Extensive questions were asked about household size, however, and Figure 3.16 gives the results plus a comparison with all Newcastle households. Whereas only slightly over a quarter of all City inhabitants live alone, nearly a third of disabled people do so. Similarly, a greater percentage of disabled people than of all City residents live with only one other person while a much smaller than average percentage of disabled people live in households of four or more people. This means that the burden of care for disabled people who do not live alone will probably fall almost entirely on one or two other people in the household. Further questions revealed that in over a third of the instances of disabled people living with only one other person, that other person (usually a spouse) was also disabled so that as many as 50% of disabled people in Newcastle either live alone or with another disabled person. It was also found that only about 1% of disabled people under 50 lived alone while 44% of those aged 75 or over did so.

As regards car availability, 45% of disabled people in Newcastle have no access at all to a car (Figure 3.17) and only about a quarter actually have a car in the household. In comparison, the survey report states that, in 1981, about 41% of all households in Newcastle had a car. Low car ownership among disabled people can be attributed to a number of factors. The onset of disability may render a person unable to drive or even sit in a car as a passenger while low incomes among disabled people will preclude the purchase of a car (or force the sale of one) in many cases. The problem of low income will be compounded by the fact that most disabled people are elderly. Moreover, relatively few elderly disabled people are likely to own a car or possess a driving licence since these were less common 20 to 30 years ago when such individuals were economically active. This is especially the case since most elderly people are female. Car ownership and possession of a driving licence are less common among women than among men and this imbalance between females and males was more pronounced in the past than it is now. Figure 3.17 reflects this fact: more disabled men than women own and use a car but a higher percentage of disabled women than of disabled men live in a household where someone else owns a car.

The part of the survey of greatest interest to this thesis is that concerned with respondents' mobility. Recipients of the postal questionnaire (Appendix X) were asked whether they could perform each of the 11 different activities easily or with difficulty, whether they needed help or were unable to carry out the activity at all. Most of these activities related to self-care in the home, for example, "dressing", "bathing", "cooking" and so on but "walking about outside" was also included on the list and a higher percentage of respondents reported problems in this respect than in any other. In fact, 72% of respondents either said they could only walk about outside with difficulty or assistance or could not do so at all. The use of the word "walking" is perhaps unfortunate since wheelchair users might state that they could not go out if they could only do so in a wheelchair. Even so, it is clear that going out poses problems for most disabled people and Figure 3.18 shows that outdoor mobility is generally more difficult than indoor mobility. 55% of respondents could move about indoors alone and unaided but only 34% of respondents could do so outside. In contrast, Harris (Figure 3.8) estimated that about 53% of disabled people could go out of doors alone, unaided and without difficulty, but at least some of this difference can be attributed to variations in survey techniques. While Harris reckoned that about 3.6% of disabled people used a wheelchair, of which 85% could go out of doors, Figure 3.18 implies that about 9% of disabled people use a wheelchair outdoors. This figure of 9% however may well be an over-estimate and the true figure is probably closer to that given by Harris. Respondents to the Newcastle survey who were given interviews were asked how far they could walk outside alone, with walking aids if necessary, and the results are given in Figure 3.19. Again, the use of the word "walking" is unfortunate and it is not clear whether walking aids includes wheelchairs. Whereas about 84% of those who gave definite replies said they could walk at least a few yards, only 41% said they could manage 100 yards or more. This suggests that the mobility of many disabled people is very limited. Despite this, it seems that very few disabled people never go out. It was estimated that only about 5% of disabled people in Newcastle never go out at all while possibly 12% go out less than once a fortnight or so. Probably at least two-thirds or three-quarters go out at least once a week. Cross-tabulations of degree of outdoor mobility, maximum distance walked and frequency of outdoor trips showed the expected results in most cases. Generally, those who can go out alone and unaided tend to be those who can walk the greatest distance and such individuals tend to go out most often and, conversely, those who have the most dificulty in walking tend to be those who can only walk short distances and consequently tend not to venture out very often. An exception to this trend was found with people who need to be accompanied when going out and in such cases the determining factor will be the health, willingness and availability of an escort. Other trends emerged, again as expected. Mobility was found to deteriorate with age, women tended to be less mobile than men and many of the less mobile were found to live alone. As already suggested, some housebound people who live alone may only be housebound because there is no-one else in the household to help them to go out.

The information on public transport use gathered by this survey is invaluable and is examined in some detail, both in this Section and in later Chapters. Use of buses and Metro implies the ability to travel to the bus-stop or station, so the usage levels of these modes are surprisingly high given the apparently short distances which many disabled people could walk (see Figure 3.19). Figure 3.20 shows the overall figures for use of public transport by disabled people in Newcastle. 62% of all disabled people responding to the postal questionnaire had a Concessionary Travel Permit. Since almost all the elderly disabled and a considerable number of the younger disabled would be eligible for a Permit, a higher proportion might have been expected. However, it is possible that many of those who could not go out or who were unable to use public transport had not bothered to apply for a permit as they would not have much use for one. The majority of disabled people (63%) used buses more or less frequently but only 32% used Metro and while the majority of those who used buses did so at least once a week, most of those who used Metro did so less frequently. About a third of disabled people used taxis but the majority of these did so rarely. While taxis can be a useful means of transport for disabled people, since they provide a personal, door-to-door service, the cost is generally much higher than buses or Metro and so they tend to be used only occasionally when the need arises. British Rail trains were used by only 16% of disabled people, of which about three-quarters used them less than once a month. Overall, trains were used only for holidays and other infrequent trips. Social Services transport, Ambulances and Community Transport are not public transport (there are also arguments as to whether taxis are public transport), but they are included in Figure 3.20 to give an idea of their use compared with conventional public transport. Of the three, Ambulances were used by the highest percentage of disabled people: just over a quarter used Ambulances, but most usage was for relatively infrequent hospital out-patient treatment. Social Services transport was used by only 5% of disabled people and Community Transport by only 6%, although at the time the survey was carried out, the Community Transport Dial-a-Ride scheme in Newcastle had only just started and so low usage would be expected.

Reasons for non-use of the Metro and users' opinions of the system will be examined in more detail in Chapter 4, but some mention of these needs to be made here. It is clear that more disabled people used buses than Metro. One obvious possible reason for this is that while the bus network covers the whole City fairly evenly, Metro does not serve all parts of the City and even in the areas it does serve, penetration of residential districts is less than that of bus services. This could have serious implications for those with restricted mobility, many of whom might be able to reach a bus-stop but not a Metro station. Figures were available in the survey report of the percentage of disabled people in each Ward in the City and also of the percentage of disabled people in each Ward who used Metro. Comparison of these would show, firstly, whether Metro use by disabled people in Wards well-served by Metro was higher than in Wards not well-served and, secondly, whether or not the greatest concentrations of disabled people were in Wards well-served by Metro. In the event, the results were not very conclusive. Not all the Wards which were well-served by Metro had higher than average percentage use of Metro by disabled people, while there was no indication that the Wards with the highest percentages of disabled people were those least well-served by Metro. Other reasons for non-use, as well as the comments on Metro by both users and non-users, will be discussed in Chapter 4.

## 3.5 The North Tyneside Survey

References to the survey carried out in the Metropolitan Borough of North Tyneside and the resultant report "The Handicapped in the Community" published by North Tyneside (1982) have already been made in Section 2 of this Chapter. This survey arose from a desire, on the part of those involved with providing care attendance for disabled people in the Borough, to gather information on the special housing and personal care needs of such individuals. The Borough Council Social Services Department soon became involved and OUTSET was also approached. OUTSET is a registered charity, set up to assist Local Authorities with surveys of the numbers and needs of disabled people in fulfilment of the requirements of the 1970 Chronically Sick and Disabled Persons' Act. It was decided to send a questionnaire to every household in the Borough, asking whether any household members were disabled and, if so, whether or not they were prepared to be interviewed. These questionnaires were distributed in early 1980, and a copy of the form is reproduced in Appendix XI. The questionnaires did not have to be returned by post but instead were collected by survey staff a few days after the initial distribution, with more than one call being made, if necessary, to collect the completed forms. Of the 77,000 households then in North Tyneside, properly completed questionnaires were received from 67,000 (about 87%) of which 6,428 contained at least one disabled person. In total, 7,106 disabled people were identified. The report stated that the population of the Borough at that time was 191,000 (although the 1981 Census gives 198,000), so that 3.7% of the population were identified as being disabled. Of these 7,106 disabled people, 5,867 were interviewed: the remainder either refused an interview or could not be contacted. The figure of 3.7% of the population said to be disabled contrasts sharply with other estimates: Harris (1971) calculated that about 6.3% of the population in 1968/69 were disabled and an updated version of this estimate suggests that about 7.3% of the present UK population are disabled (see Section 3 of this Chapter). The report published by the City of Newcastle upon Tyne (1972) suggested that 7.4% of the then population of the City were disabled, while a later report also by the City of Newcastle upon Tyne (1985) suggested that about 7.5% of the City population were disabled (see Section 4 of this Chapter). An estimate of the potential "market" for the facilities for disabled people on Metro, arrived at by calculating the number of disabled people in the Tyne and Wear area, will form an important part of later Chapters of this thesis, so that an accurate estimate is needed. There is little variation in the percentage of the population identified as disabled by Harris and the two Newcastle City surveys and if the estimates from these three surveys are applied to the current population of the Tyne and Wear area (about 1,140,000) then somewhere between 83,000 and 86,000 people in Tyne and Wear can be said to be disabled. If, however, the North Tyneside estimate is applied to the area population, then it appears that there are only about 42,000 disabled people in Tyne and Wear - about half the number given by the other three surveys.

It would be tempting simply to disregard the North Tyneside results on the grounds that they must be suspect but since the area forms part of Tyne and Wear (see Figure 3.1), some attempt should be made to obtain a dependable estimate of the number of disabled people in the Tyne and Wear area. The author is greatly indebted to L B Mullett of the Transport and Road Research Laboratory for his help in establishing possible reasons for the discrepancy. With his assistance, an examination of the survey technique and questionnaire distribution in each case revealed a number of points. Firstly, the questionnaire form used by Harris for Sample A (see Appendix IX) was well set-out and easy to follow and the form was to be returned whether or not any household members were disabled. Most recipients should therefore have been able to complete the form correctly without too much difficulty and there was no advantage in concealing any disability - two factors which would be expected to produce both a good response rate and fairly accurate results. Secondly, the main element of the 1972 Newcastle City survey comprised a "door-step" survey in which a sample of 6% of households in the City were asked a number of questions intended to ascertain whether any household members were disabled. These questions included whether anyone in the household: had problems with eyesight or hearing; lacked any limb or part of a limb; had difficulty with mobility or self-care, or was unable to participate in education or obtain work due to health problems. The questions asked probably covered most disabilities and a door-step survey would be expected to produce a better response than a more easily-ignored postal questionnaire. In consequence, a good response rate and a high degree of accuracy would be anticipated. Thirdly, the questionnaire used in the 1985 Newcastle City survey (see Appendix X) had to be filled in and returned whether or not any household members were disabled or over 75, and included questions on sight and hearing. Although quite long, it was easy to follow so that, once again, the results are probably quite accurate.

By comparison, the North Tyneside survey questionnaire was less satisfactory (see Appendix XI). In an attempt to condense all the necessary information, instructions and questions onto a single A4-size sheet, clarity had been sacrificed for the sake of brevity. The form is not easy to follow and the use of a grid for answers resulted in some instructions being set at a right angle to the others. Overall, the questions concentrated much more on physical disabilities, mobility problems and self-care at home, but the biggest drawback was that it was all too easy to tick the box "Not Handicapped" and "have done" with the questionnaire. Once again, it was simpler to conceal a disability than give details of it. As a result, a lower incidence of disability could be expected, but 3.7% seems unreasonably low and it is difficult to see how all of the discrepancy is accounted for by the factors outlined above, or to suggest any others which might have been responsible. It is possible that the percentage of disabled people in North Tyneside in 1980 was actually lower than that among the population of Great Britain in 1971, as calculated by Harris or updated for 1985, but this would seem improbable. North Tyneside contains areas of heavy industry (which might be expected to result in high percentages of disabled people) and also coastal towns with substantial numbers of elderly (and often disabled) people. Moreover, the percentage of disabled people in the population is increasing, as has been stated earlier, and so some increase would be expected for North Tyneside in 1980 over the whole country in 1971. In considering the North Tyneside figures compared to those for Newcastle City, a great disparity would appear even less likely, since they are adjoining areas (see Figure 3.1). The only difference which could be expected is that the North Tyneside figures might be slightly higher than the 1972 Newcastle figures for the same reason that they could be higher than those originally calculated by Harris.

Given this disparity between the results of the North Tyneside survey and those of all the others, the former could be dismissed entirely. It appears that some major error or errors in data collection or analysis resulted in an underestimate of the incidence of disability greater than that caused by the factors outlined above. However, some of the major findings of the survey will be examined briefly but these figures will be used with caution. As well as the problems outlined above, the International Classification of Diseases was not used by North Tyneside. Instead, respondents' disabilities were grouped according to a system devised by Agerholm (1975), details of which were given in an appendix to the North Tyneside report. Consequently, comparisons with the figures given by Harris and the Newcastle City survey are rather difficult. However, the North Tyneside survey does give breakdowns into specific disabilities in the case of conditions with large numbers of sufferers. These are shown in Figure 3.21 and include most of the main problems affecting mobility. The figures are given in terms of the percentages of the total population of North Tyneside suffering from each disability, and comparable figures from Harris and the Newcastle City survey are included. It is significant that the rankings of the diseases are almost identical for all three surveys, although the percentages of the total population suffering from the various diseases are lower in the North Tyneside survey, as would be expected if this survey does indeed underestimate the number of disabled people in the Borough.

Figure 3.22 indicates the age distribution of disabled people in North Tyneside in terms of the percentage of disabled people in each age group and also gives the percentage of the total population of North Tyneside in each age group. This information can therefore be compared with both Figure 3.7 and Figure 3.14, as well as Harris's data on the age distribution of the UK population. In North Tyneside, as in Harris's figures, the age distribution is almost the exact reverse of the total population: whereas most disabled people are elderly, over half the total population of North Tyneside is under 50. Figures from the sex distribution of disabled people in North Tyneside again show much the same trend as Harris (Figure 3.7) and the Newcastle survey (Figure 3.15). In North Tyneside, slightly over half of disabled people under the age of 25 were male, but nearly three-quarters of disabled people aged 75 and over were female. Overall, an estimated 58% of disabled North Tynesiders were women. Harris suggests that the incidence of disability, i.e. the percentage of people who are disabled, is higher among elderly people than among younger age groups: her figures indicated that barely 1% of all those aged between 16 and 29 were disabled, while 38% of those aged 75 or more were disabled. The North Tyneside results also showed this trend. About 0.5% of those aged under 25 were disabled compared to 17% of those aged 75 or over: the fact that the percentages were lower than those suggested by Harris is again because the North Tyneside survey under-estimated the number of disabled people in the Borough.

Since the North Tyneside survey arose from a desire to gather information on the special care and housing needs of disabled people, mobility was not investigated to any great extent. Although interviewees were asked whether or not they could go out alone and without difficulty, they were not questioned as to the frequency of going out or use of public or other transport. Figure 3.23 gives the mobility characteristics of disabled people in North Tyneside. By far the largest category is that of "Ambulant but restricted" and nearly 59% of disabled people in North Tyneside placed themselves in this group (the categories were not mutually exclusive and respondents could list as many categories as they felt applied to them). Once again, the categories in the North Tyneside survey, the Harris study and the Newcastle City survey do not "match" so that direct comparison is difficult. In addition, the fact that North Tyneside interview respondents could give more than one category if appropriate also means that the North Tyneside results cannot be compared directly with those in the two other surveys. Moreover, it is not clear whether, in the North Tyneside survey, reference to "mobility" meant outdoor mobility only or indoor and outdoor mobility together. Despite these variations, the general picture is that the majority of disabled people were ambulant out of doors, even if an aid or escort was required or difficulty was encountered. The Newcastle City survey suggested that about 9% of disabled people used a wheelchair outdoors while nearly 12% of North Tyneside respondents were either wheelchair-bound or wheelchair-users (Figure 3.23). Both these percentages are probably over-estimates and the true figure is almost certainly closer to the updated version of Harris's estimate, which suggests that about 4% of disabled people use a wheelchair.

Figure 3.24 lists the difficulties encountered by disabled people when going out and the percentages of people who experienced difficulty from each source. The totals exceed 100% because respondents were again able to list all the areas of difficulty which applied to them. Nearly two-thirds said that they had difficulties as pedestrians, and about 53% encountered difficulties on public transport. Other areas causing problems to substantial percentages of disabled people included actually getting into and out of the house, using shops and the onset of fatigue. No attempt was made to establish the precise nature of, for example, the difficulties encountered when using public transport.

It is unfortunate that the North Tyneside survey appears to underestimate the number of disabled people in the Borough by such an extent - the figure is, in fact, about half that indicated by the Harris study and the two Newcastle surveys. This is especially disappointing since, as previously pointed out, an estimate of the total "market" for facilities for disabled people on Metro will form part of the cost-effectiveness analysis in Chapter 6 of this thesis, a calculation which can only be achieved by using data on the numbers of disabled people in the Local Authority districts which comprise the Tyne and Wear area. However, one feature to emerge from the North Tyneside investigation is a special study of the wheelchair users identified by the survey, which will be described in Section 6 of this Chapter.

## 3.6 A survey of wheelchair users in North Tyneside

The current design of London taxicab, the FX4, was originally introduced in the late 1950s, being manufactured by Carbodies Ltd of Coventry, using Austin running units. By 1981, the International Year of Disabled People, Carbodies had designed a replacement model, code-named CR6 and in that year, the Department of Transport persuaded Carbodies to modify the CR6 design to accommodate passengers in wheelchairs. The Department then purchased two prototypes of the wheelchair-accessible design and placed a contract with the Transport Operations Research Group (TORG) and the Design Unit of the University of Newcastle upon Tyne to monitor the operating trials of these prototypes. During these trials, special note was to be taken of the ease with which disabled people, particularly wheelchair users, could enter and leave the vehicle and manoeuvre within it. At the same time, critical decisions were pending concerning the internal dimensions of the passenger compartment of the production version and information was thus urgently required on the range of sizes and types of wheelchairs currently in use in Britain. Although the Department of Health and Social Security (DHSS) maintain records of the issue of wheelchairs, these records do not include information on privately-bought wheelchairs. Moreover, some DHSS wheelchairs are adjustable so that dimensions are not readily discernible from records of issue and no record is kept of wheelchairs returned to the DHSS, or of the use to which chairs are put. The latter point is of some importance since many DHSS wheelchairs are only used indoors or in institutions and the dimensions of these may differ from those of chairs used outdoors, only the latter being of interest to the CR6 project. A new survey of the types and dimensions of wheelchairs in outdoor use was thus required. Fortunately, the report by North Tyneside (1982) on their survey of disabled people undertaken in conjunction with OUTSET had recently been published (see Section 5 of this Chapter). The Borough Council Social Services Department were approached concerning the projected wheelchair-size survey and agreed to ask all the wheelchair users identified by their own study whether they would participate in another survey. 786 people were approached in this way, of which 606 agreed to co-operate and the names and addresses of these individuals were then passed to TORG. This represented 77% of the wheelchair users identified by the original survey but no information was available on either the number of new users of wheelchairs or the number of wheelchair users who had moved into the Borough since the earlier survey. However, in the course of the survey, some participants provided names and addresses of other wheelchair users. Sixty such people were identified in this way, giving a total of 666 potential interviewees. Each of these was sent a brief letter by TORG, giving details of the survey and suggesting a date and time for interview. A reply-paid envelope and a telephone number were supplied to enable rearrangement of interviews and withdrawals from the survey. Eventually, 325 people were interviewed, a response rate of almost 50%, most of the remainder having died, moved or refused an interview. There is no evidence to suggest that the 325 people interviewed were not representative of wheelchair users in North Tyneside but, as discussed in Section 5 of this Chapter, the original survey of disabled people undertaken by the Borough Council and OUTSET probably underestimated the results.

Following a small pilot survey in late 1982, interviews of wheelchair users were carried out between February and April, 1983.

Although the main aim was to gather information concerning size and types of wheelchairs, interviewees were also asked about their cause of disability, mobility characteristics and travel patterns. The opportunity was also taken to ask some questions on respondents' use of Metro. A full description of the survey, together with findings and conclusions, is given in the report by Hall and Silcock (1985).

Figure 3.25 shows respondents' disabilities and arthritis is once again the most often-mentioned problem, but amputations and paralysis are more predominant among wheelchair users than among disabled people as a whole. The age and sex distribution of respondents is given in Figure 3.26 and as with disabled people generally, the majority are elderly and the majority of elderly respondents are women. Interviewees were asked whether they could walk at all and although two-thirds could walk indoors (with an aid or escort if necessary) only 23% could walk outside, of which more than half said they could not walk for more than 50 yards. As regards ability to self-propel, 22% of respondents said they could propel themselves outdoors but about half of these could not do so for more than 200 yards. Thus the majority of wheelchair users appear to be both wheelchair-bound and dependent upon an escort for propulsion for longer journeys. About 13% of respondents lived alone, this figure being lower than for disabled people generally, probably because wheelchair users are less able to look after themselves. However, a further 10% of respondents lived with a disabled spouse only. Approximately 37% of respondents had a car in the household, and of these about half actually owned a car themselves (including "invalid" cars and conversions). Nearly 16% of respondents were able to obtain lifts from neighbours or others and the remaining 47% had no access to a car at all. The 325 respondents owned a total of 408 wheelchairs between them. Quite a number possessed two wheelchairs and at least one person had three, while five of the wheelchairs in the survey were part of a "pool" of chairs in an institution and were available as needed to residents. Many of those who had two chairs used one for outdoors and one for indoors. Overall, about 9% of the 408 wheelchairs had been obtained privately, but about 41% of those privately owned were electric. Figure 3.27 shows the types of chairs owned.

Turning to outdoor mobility, respondents were asked for details of all outdoor journeys made in the week prior to the interview and whether this represented a typical week's journeys. 180 respondents (about 55%) said they had gone out at least once in the week prior to interview and these respondents had made a total of 1,130 journeys between them, resulting in an average of just under one trip a day for those respondents who did go out and 0.5 trips per day for all respondents. The interviews were conducted in February to April, 1983 and about half the respondents remarked that in the week prior to being interviewed they had gone out less often than usual, mainly because of the cold weather. Only 3% of interviewees said they had gone out more than usual. However, it was not possible to quantify the reduction in trips compared with respondents' normal travel patterns. About 81% of trips were made with an escort but assistance was only said to be necessary for 49% of journeys. The National Travel Survey for 1978/79 published by the Department of Transport (1983) suggests an overall national average of just over three trips per person per day so that, even allowing for seasonal factors, respondents made far fewer journeys than average. The use of different modes by respondents is given in Figure 3.28 by showing the percentage of journey-stages made by various modes. Comparable figures for the national population, taken from the National Travel Survey, are also given. According to these results, wheelchair users tended to make a larger than average percentage of their journeys by private transport. Within this overall trend, wheelchair users relied more than average on cars, vans, etc. and much more on "other" private transport, which is to be expected as this latter category includes all minibuses, ambulances and other specialised transport. Given the difficulty, indeed the impossibility in most cases, of wheelchair users getting on a bus, the low percentage of wheelchair users' journeys made by bus is not surprising. Higher than average use of taxis is due to the fact that they provide a personalised, door-to-door service, but at a high cost which probably prevents greater use being made of this mode. Figure 3.29 gives a more detailed breakdown of the modes used by North Tyneside wheelchair survey respondents and includes the percentage of journey-stages made by Metro. Slightly over one in five journey-stages comprised travel in a wheelchair but few of these were unescorted. Only 2% of all journey-stages were made by Metro. Respondents were asked a number of questions concerning Metro and these will be discussed in detail in Chapters 4 and 5. However, some comments will be made here.

A total of 107 respondents (about 34% of those who answered this question) replied that they had used Metro. The section of line between Tynemouth and St James, running through the southern part of North Tyneside, had only been open for a few months at the time of the survey, so respondents were therefore asked whether they intended to use Metro in the future. A further 6% of all those questioned said they had not used Metro in the past but would do so at some time. Ninety-nine respondents (about 30% of the total) possessed a Concessionary Travel Permit and for the most part, the majority of the Metro users were Permit holders and vice versa. Of the Permit holders, nearly two-thirds said that their Permits would open the wide barriers. As mentioned earlier, a more detailed analysis of respondents' use of Metro, opinions of the system and reasons for non-use, where appropriate, will be given in Chapters 4 and 5.

## 3.7 A Survey of Elderly and Disabled People within the Tyne and Wear Public Transport Impact Study

A household travel survey was conducted in Tyne and Wear in 1979 as part of the Tyne and Wear Public Transport Impact Study (PTIS) with the aim of assessing the effects of the Tyne and Wear Metro by undertaking "before" surveys prior to its opening and "after" surveys once it was operational. In the event, the PTIS was curtailed and the "after" part of the survey was cancelled, although the data from the "before" studies were made available to the author of this thesis through the co-operation of the Transport Planning Division of the Transport and Road Research Laboratory.

For the purpose of the household survey, a total of 17 "cluster" areas were devised within Tyne and Wear. These clusters were chosen to represent a variety of degrees of access to public transport and, in addition, some clusters were expected to have much improved public transport provision once Metro had opened, while others were "control" areas away from Metro. Although the clusters were not intended to give a representative sample of all households in Tyne and Wear, most of the survey results indicated that, when taken together, the clusters were fairly representative of Tyne and Wear as a whole. Within each cluster, a random sample of households was contacted and interviews were obtained with every person in households which co-operated with the survey. The main areas of interest in the interviews were household size, tenure, car ownership and income, general details of all household members, and information on travel patterns. In all, 7,567 households were interviewed, containing a total of 20,399 people. PTIS was not specifically intended to be a survey of elderly and disabled people, but four questions among those on the personal details of household members gave an indication of the number of elderly and disabled people within the sample population. These questions were:

i) Age;

ii) Travel Pass held (if any) - this indicated the numbers of people with Disabled Persons' or Old Age Pensioners' Concessionary Travel Permits;

iii) Occupation - there were a total of eight occupational categories including "Retired" and "Long Term Sick", the latter being defined as not having worked in the past six months for health reasons;

iv) Health - respondents were asked whether, due to health problems, they had difficulty with journeys on foot, difficulty with journeys by bus or difficulty with both journeys on foot and journeys by bus, or whether they were housebound.

The health question thus gave an indication of handicap but did not highlight the disability, i.e. cause of the handicap. Given the above questions, it is possible that a person might have been disabled and yet not "show up" in any of the above categories, but the number of such individuals must surely have been quite small. As mentioned earlier, the clusters were not chosen in order that the resultant overall PTIS sample population would be a totally representative sample of the population of Tyne and Wear, but there is no reason to suppose either that the PTIS sample population contained an unrepresentative number of disabled and elderly people or that the disabled and elderly people in the sample were unrepresentative of disabled and elderly people as a whole. Consequently, the value of the PTIS to this thesis lies in the fact that it was a survey of household travel patterns, in which the characteristics and travel patterns of disabled people could be measured against those of the sample population as a whole. From the question on age, it emerged that nearly 14% of respondents were aged 65 or over. Not all of those individuals would be disabled but the estimates of the incidence of disability among elderly people given in previous Sections of this Chapter suggest that about 20% of those aged between 65 and 75 and 40% of those aged over 75 would be. With regard to Permit holding, slightly over 15% of PTIS respondents held an OAP Concessionary Travel Permit (this would include some women aged between 60 and 65) but only about 2% held a Disabled Persons' Permit. This was considerably less than the number of disabled people in the sample population (see later) for three main reasons. Firstly, many disabled people are elderly, as shown by surveys described in previous Sections of this Chapter, and may thus hold an OAP Permit even though they would also be entitled to a Permit on grounds of disability as well as age. Secondly, a paradox of the issue and take-up of Disabled People's Permits is that many of those who are eligible may not be able to use public transport and thus would not bother to apply for a Permit which would be of no use to them. Thirdly, there is almost always a less than 100% take-up rate for any welfare benefit or entitlement for reasons which are not always clear.

The actual take-up rate of Old Age Pensioners' Concessionary Travel Permits can be calculated quite easily for the PTIS sample population. Appendix II contains a description of the Concessionary Permit Scheme and the conditions of issue. From this it is clear that virtually all those over retirement age would be eligible and, when the number of females aged 60 to 65 are added to the 14% of the sample shown to be over 65, a total of about 17% of the sample were over retirement age. Assuming that all of these would be eligible for a Permit, the take-up rate can be calculated as nearly 88%, given that approximately 15% of the sample held an OAP Permit. However, it is impossible to calculate the take-up rate of Disabled Persons' Permits with the same confidence. No category within any of the PTIS questions gives an exclusive and accurate indication of the total number of disabled people who were eligible for a Disabled Persons' Permit. The fact that 2% of the sample held a Disabled Persons' Permit while Figure 3.30 shows that 2% of the sample were Long-Term Sick, is purely coincidental as a cross-tabulation of the variables "Travel Pass Held" and "Occupation" showed that nearly two-thirds of Disabled Persons' Permit holders were in occupational categories other than Long-Term Sick. Similarly, there is no way of determining how many of those with various difficulties, as shown in Figure 3.31, were eligible for a Permit on grounds of disability, in order to calculate the take-up rate by this means. According to Figure 3.30, 2% of PTIS respondents said they were Long-Term Sick, i.e. had not worked for health reasons in the previous six months, but this was certainly lower than the total number of disabled people. A number of disabled women would probably give their occupation as housewife, while a substantial number of disabled people of both sexes would be elderly and may be expected to give their occupation as retired. Additionally, small numbers of disabled people would be expected in most other categories.

The question on health can, however, be expected to give a much more accurate indication of the number of disabled people in the PTIS sample population - or at least the number of people whose disabilities led to mobility problems. Figure 3.31 shows that 8% of the PTIS sample had some difficulty or were housebound, a figure slightly above the percentage of people estimated to be disabled by Harris (1971), when updated, and by the City of Newcastle upon Tyne (1985) but considerably greater than the estimate by North Tyneside (1982).

The main usefulness of the PTIS data to this present thesis is in showing the income, household size, car ownership and travel patterns of elderly and disabled people within a general sample of the population as a whole and by comparing the characteristics of elderly and disabled people in these respects with those of the whole sample population. Figure 3.32 shows the household income distribution for each of the categories indicating old age or disability compared to the household income of the sample as a whole. It should be noted that the data on income are described in PTIS documentation as somewhat suspect due to a reluctance on the part of some of those interviewed to discuss the matter. In fact, about 5% of the PTIS sample as a whole refused to give details of their household income (a higher percentage than for any other question) and many of those who did give details supplied only rough approximations. Nevertheless, even a glance at Figure 3.32 reveals that just over a quarter of the total PTIS sample had annual household incomes of under £3,000, but the majority of all the groups of elderly and disabled people were in this category. Similarly, while nearly 10% of the total PTIS sample had incomes of over £9,000, much smaller percentages of each group of elderly or disabled people had this level of income. Obviously, some of this reduction in income would be due solely to old age and retirement rather than because of disability, but about 58% of people in the Long-Term Sick category had incomes below £3,000 per annum. Most of this category might be expected to be of working age, since the majority of disabled people of retirement age or over would be expected to give their occupation as Retired. Consequently, disability as well as age, clearly reduces income.

Other surveys analysed in previous Sections of this Chapter have already shown that disabled people tend to live in smaller size households than average, and a significant number of disabled people live alone. A survey of households, such as PTIS, is of great use in investigating this tendency. Figure 3.33 does indeed indicate that while just under 8% of the total PTIS sample lived alone, considerably larger numbers of most categories of elderly and disabled people did so. The effect of age does seem greater in this case than that of disability since almost a third of each of the three groups indicating old age lived alone. In contrast, of the groups which were probably composed mainly of younger disabled people, smaller percentages lived alone, although even here the figures were above average. Interestingly, just over 32% of housebound people lived alone and as stated earlier in this Chapter, it is likely that some of these people were housebound only because there was no-one to take them out. Figure 3.34 indicates that about 53% of all PTIS respondents lived in households with no car. By comparison, about three-quarters or more of all categories of elderly and disabled respondents had no household car, thus confirming the tendency already described in earlier Sections of this Chapter.

The PTIS thus enables the general characteristics of elderly and disabled people to be compared with those of a sample of the total population of Tyne and Wear, but the real value of the PTIS consists of the information on travel patterns. Given the mobility problems of elderly and disabled people, lower than average trip rates would be expected and Figure 3.35 shows this to be the case. The numbers of one-way trips per day made by the various categories of elderly and disabled people are given, together with those of the PTIS sample as a whole. Although some clusters showed greater overall trip-making activity than others, the overall tendency for elderly and disabled people to make fewer than average trips was the same in each cluster, so the trip rates given in Figure 3.35 are for all the clusters taken together. The resulting pattern was very much as expected, with all categories of elderly and disabled respondents making fewer trips than average. Trip-making declined with increasing old age: the "young elderly", i.e. those aged between 65 and 70, made more trips than the very old (aged 76 or over). Similarly, those who reported difficulty with both journeys on foot and with journeys by bus made fewer trips than those who reported difficulty only with one or the other. "Housebound" people made only negligible numbers of trips but it is surprising that respondents in this category were able to go out at all. The National Travel Survey for 1978/79 published by the Department of Transport (1983) suggested an average of roughly three trips per person per day, roughly in line with the PTIS overall average of 2.8 trips per person per day.

Given that elderly and disabled people make fewer journeys than average, is this solely due to the absence of work trips? Most elderly and disabled people are not in employment, so a major reason for making trips (the journey to work) disappears. If this is the case, then elderly and disabled people are not really deprived of the ability to make trips but instead it could be argued that they are relieved of what is to many the unpleasant daily necessity of getting to and from work. However, this is not the case. The PTIS interview included questions on the purpose of each journey made. It was found that on average, each PTIS respondent made about 0.4 work trips per day, while the work trips made by most categories of elderly and disabled people were negligible. In other words, each PTIS respondent made about 2.4 non-work trips per day on average, which is still higher than all the categories of elderly and disabled people, as given in Figure 3.35. Consequently, it is clear that elderly and disabled people's trip-making is reduced by factors other than the absence of a need to make work trips. As well as journey purpose, the PTIS interview sought information on the modes used for all the journeys made, with special reference to the number of journeys made using public transport. However, when the figures for the number of public transport trips made by elderly and disabled PTIS respondents were compared to those made by the total PTIS sample, the results were inconclusive. A few categories of elderly and disabled people made more public transport trips per day than average, but the difference was only slight. Nevertheless, the PTIS does show, as outlined above, that elderly and disabled people are generally poorer than average, live in smaller households than average, tend not to have a car in the household and tend to go out somewhat less than average.

The overall aim of this Chapter has been to examine the various surveys, both local and national, which give an indication of the numbers and needs of disabled people. From these surveys an estimate will be made of the numbers of people with various disabilities in Tyne and Wear as a whole, together with a description of the travel requirements of such individuals. This information is contained in the next Section.

## 3.8 Numbers and mobility of disabled people in Tyne and Wear

The aim of this Section is to use the results of the various surveys analysed in previous Sections of this Chapter to arrive at estimates of the numbers and mobility needs of disabled people in Tyne and Wear. Later Chapters will evaluate the use of Metro by disabled people in the light of the total disabled "market potential" so it is essential to arrive at some basic estimates of the number of disabled people in Tyne and Wear. Unfortunately, no general survey of disabled people in the area has ever been undertaken, since the responsibility for such surveys lies with District rather than County Councils. It is equally unfortunate that, of the two recent Local Authority surveys undertaken within Tyne and Wear, the results of that carried out by North Tyneside (1982) are suspect. Consequently, updated versions of the results obtained by Harris (1971) are more reliable and are used in this Section together with those from the survey report published by the City of Newcastle upon Tyne (1985). A further difficulty arises because Metro does not serve all parts of the Tyne and Wear area equally well. Should, therefore, the estimates of the "market potential" for Metro's facilities for disabled people be based only on the number of such individuals within easy reach of a Metro station? A glance at Figure 3.1 shows that this would exclude disabled people in the whole of the Metropolitan District of Sunderland as well as in parts of the four other Local Authority areas making up Tyne and Wear, but would probably include disabled people in parts of Northumberland. Given the restricted mobility of disabled people, the problem of defining "within easy reach" then arises. The answer surely lies in the original intentions of those responsible for planning and building Metro. The archive material discussed in Chapter 2 and in Section 1 of this Chapter shows that those responsible for Metro (mainly members of the former Tyneside PTA and PTE and of Tyne and Wear County Council and PTE) planned the system almost exclusively with Tyne and Wear in mind. Indeed, one particular facility, that of a Concessionary Travel Permit for all public transport in Tyne and Wear, is available on the same terms to elderly and disabled people throughout the area, irrespective of Local Authority boundaries. In addition, the entire cost of facilities for disabled people was met by the County Council, since no Department of Transport Infrastructure Grant was forthcoming for the additional cost of these facilities (see Chapter 2). Consequently, it would seem logical to base calculations of the "market potential" for facilities for disabled people on Metro on the number of persons in Tyne and Wear with physical difficulties or visual impairment but who are able to go out of the house. The facilities for disabled people are of use to others, but this will be discussed in later Chapters.

At the time of the 1981 Census, the population of Tyne and Wear was slightly over 1,140,000. If the results of the various surveys analysed in Sections 3 to 6 of this Chapter are applied to the Tyne and Wear population, it can be estimated that there are between 42,000 and 86,000 disabled people in Tyne and Wear, while the PTIS figures (see Section 7) suggest that about 91,000 people in the area have some sort of mobility problem. Two surveys can immediately be discarded: the suspect North Tyneside survey and the earlier survey by the City of Newcastle upon Tyne (1972) which has now been superseded by a later survey, also by the City of Newcastle upon Tyne (1985). Once these two suspect studies are removed, the three remaining estimates give the total number of disabled people in Tyne and Wear as 83,000 (on the basis of the updated version of the Harris figures), 86,000 (using the 1985 Newcastle City survey results) or 91,000 (using the PTIS figures). Some of these people would be housebound and others would suffer from problems other than physical or visual impairment. Of the three surveys, Harris estimated that 13% of disabled people were housebound, the Newcastle City survey suggested 7% and the PTIS 13%. If these percentages are applied to their respective surveys and the estimates derived therefrom, the number of disabled people, able to go outdoors, in Tyne and Wear can be estimated as 72,000 (Harris estimate), 79,000 (PTIS estimate), or 80,000 (Newcastle City estimate). The next step is to identify and eliminate from calculations all those who are disabled yet do not have any physical or visual impairment, for example, people whose disability arises solely from mental impairment or from hearing difficulties. It will be remembered that the Harris interview questionnaire asked for the main cause(s) of disability, while respondents to the Newcastle City survey were asked to state all the disabilities from which they suffered. Harris's results indicated that about 16% of disabled people said their main cause(s) of disability arose from conditions other than physical or visual impairment, but this would include some people who suffered from physical or visual impairment to a lesser degree. Meanwhile, the results of the Newcastle City survey indicated that about 21% of disabled people had problems other than physical or visual impairment, but in contrast to the Harris survey, this would include an unknown number of people whose main problem arose from physical or visual impairment but who also had other disabilities to a minor extent. It is probably best to reduce the various estimates of the number of disabled people in Tyne and Wear, able to go out, by 16%, i.e. the number who Harris estimated suffer mainly from problems other than physical or visual impairment. On this basis, the number of physically disabled or visually impaired people in Tyne and Wear who are able to go out lies between about 60,000 and 67,000. This amounts to between approximately 5% and 6% of the population of Tyne and Wear and, in the calculations in the rest of this Section, these two figures of 60,000 and 67,000 will both be used in order to give "high" and "low" estimates in all cases. The results of the various surveys analysed earlier in this Chapter can be used to give indications of the characteristics, including mobility, of these 60,000 to 67,000 people. Figure 3.36 indicates the probable numbers of non-housebound disabled people in Tyne and Wear with physical or visual impairment broken down into specific diseases. This table reverts to the Newcastle City survey for an indication of the percentage breakdown into specific diseases, since respondents in this case were asked to give all the diseases from which they suffered. Consequently, the percentage totals in Figure 3.36 exceed 100 since some individuals would have more than one disability. Figure 3.37 shows the estimated age distribution of non-housebound disabled people in Tyne and Wear with physical or visual impairment, based on the age distribution figures from the 1985 Newcastle City survey only, since other surveys use different age groupings, but the overall trend is the same for all the different surveys. The estimates of the sex, household size and household car ownership of non-housebound disabled people in Tyne and Wear with physical or visual impairment are given in Figure 3.38. These figures are taken from the Harris study and the 1985 Newcastle City survey, except that the percentage of disabled people with no household car is based on the 1985 Newcastle City survey only.

With regard to outdoor mobility, the percentage of disabled people who are housebound has already been established and taken into account. Figure 3.39 gives estimates of the numbers of disabled people in Tyne and Wear with physical or visual impairment who are able to go out, disaggregated according to ability to go out alone, unaided or without difficulty. The totals do not necessarily add up to the total estimated number of disabled people in Tyne and Wear, because they are composed of "high" and "low" percentages, taken in turn from "high" and "low" estimates. Figure 3.40 provides estimates of the numbers of disabled people in Tyne and Wear with physical or visual impairment able to travel various distances, these being based on data from the 1985 Newcastle City survey only, since none of the other surveys asked respondents how far they thought they could travel. About 41% of disabled people, it seems, are able to travel over 100 yards and it is this group which will probably constitute the main "market" for the facilities for disabled people on Metro.

The data from the Harris, Newcastle City and North Tyneside surveys (described earlier in this Chapter) can be combined with the results of the survey of wheelchair users in North Tyneside (Section 6 of this Chapter) to give estimates of the numbers and characteristics of wheelchair users in Tyne and Wear. As already stated, the original North Tyneside survey almost certainly under-estimated the numbers of disabled people (including wheelchair users) in the area and this will be taken into account in the following estimates. Figure 3.41 gives calculations of the number of wheelchair users in Tyne and Wear, whether or not they are confined to a wheelchair and the number of housebound wheelchair users. The calculations in Figure 3.41 are based on the total estimated numbers of disabled people in Tyne and Wear, whether housebound or not and irrespective of the cause of disability.

Overall, the estimates in the above figures show that out of the 1,140,000 people in Tyne and Wear:

i) Between 60,000 and 67,000 have some physical disability or visual impairment but are able to go outdoors;

ii) Between 43,800 and 48,900 of these have no household car;

iii) Between 24,600 and 27,500 can walk for more than 100 yards outdoors, with an aid or escort if necessary;

iv) There are between 2,100 and 7,000 wheelchair users who are able to go outdoors (although 7,000 is probably an over-estimate).

The most likely potential users of Metro are the 24,600 to 27,500 disabled people able to walk more than 100 yards (hopefully including all wheelchair users able to travel that distance), of which some will have cars which will reduce their likely use of Metro. It is important to note, however, that the potential "market" for Metro's facilities for disabled people is, on this reckoning, much smaller than the 7% or so of the population estimated to be disabled: 24,600 to 27,500 amounts to between 2.2% and 2.4% of the Tyne and Wear population This is not to say that these are the only disabled people likely to use Metro and its facilities, or that disabled people are the only persons likely to benefit from facilities on Metro designed for them, but among disabled people, this group are probably the most likely potential users of Metro. This will be borne in mind in future Chapters on the numbers of disabled Metro passengers and in evaluating the effectiveness of the investment in facilities for disabled people on Metro.

Figures - Chapter 3

Figures - Chapter 3 (continued)

Figures - Chapter 3

Figure 3.1 : Map of Tyne and Wear showing districts

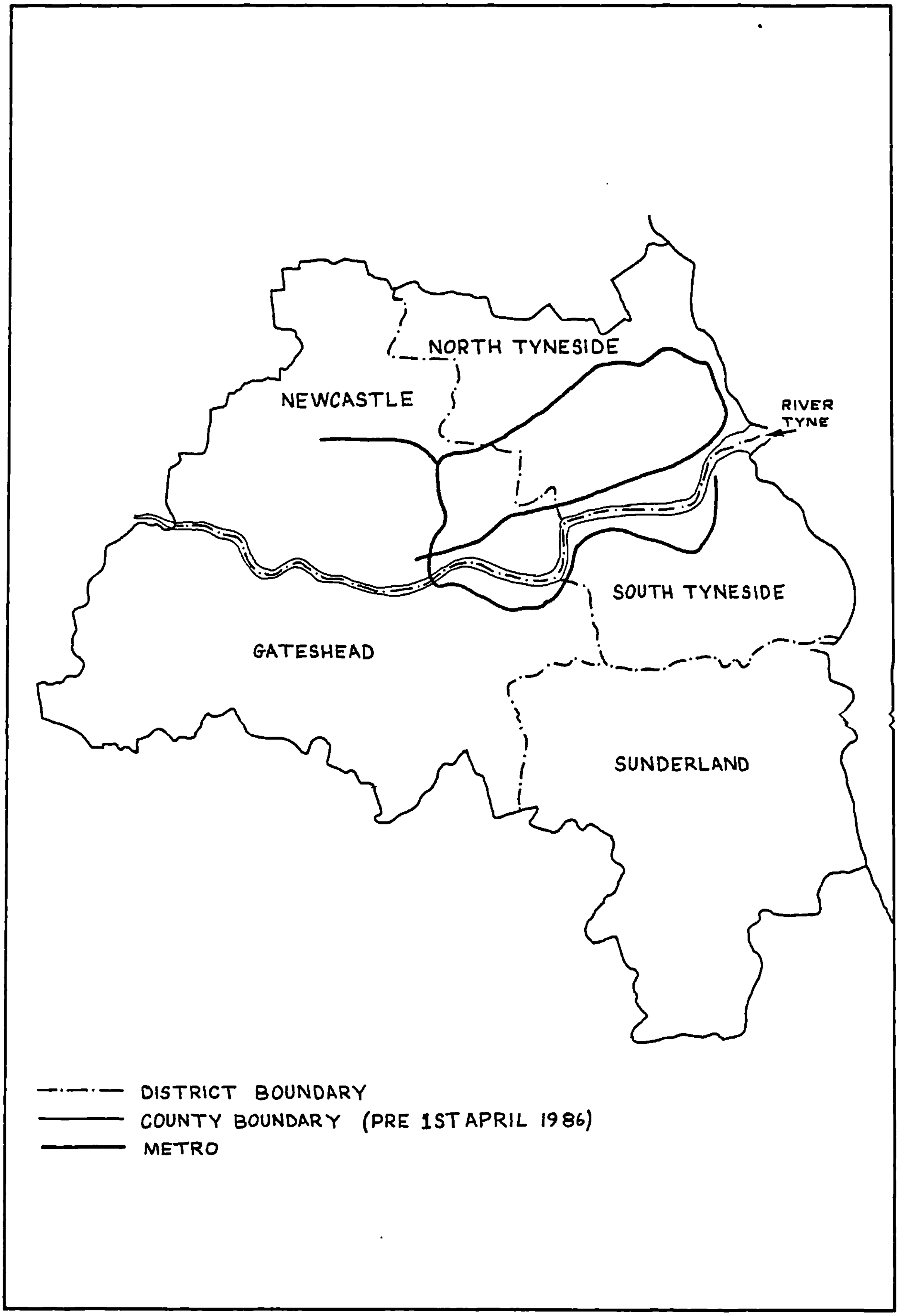


Figure 3.2 : Main Causes of Disability in Great Britain, as identified by the Harris study and updated

| | A<br>Main Cause of Disability | B<br>No. aged 16 & over living in private households, 1971 | C<br>Total No. in Britain, 1985 |
|---|---|---|---|
| I | Infective and Parasitic Diseases | 30,000 | 39,000 |
| II | Neoplasms (cancer and other growths) | 27,000 | 35,000 |
| III | Allergic, endocrine, metabolic and nutritional diseases | 51,000 | 66,000 |
| IV | Diseases of blood and blood-forming organisms | 28,000 | 36,000 |
| V | Mental, psycho-neurotic and personality disorders | 98,000 | 128,000 |
| VI | Diseases of central nervous system | 360,000 | 469,000 |
| VII | Diseases of circulatory system | 492,000 | 641,000 |
| VIII | Diseases of respiratory system | 284,000 | 370,000 |
| IX | Diseases of digestive system | 82,000 | 107,000 |
| X | Diseases of genito-urinary system | 35,000 | 46,000 |
| XI | Disorders of sense organs (including blindness) | 277,000 | 361,000 |
| XII | Diseases of skin and cellular tissue | 20,000 | 26,000 |
| XIII | Diseases of bones and organs of movement | 1,187,000 | 1,546,000 |
| XIV | Congenital malformation | 16,000 | 21,000 |
| XV | Injuries and amputations | 243,000 | 316,000 |
| XVI | Senility and ill-defined conditions | 122,000 | 159,000 |

Classifications according to International Classification of Diseases, 1959. Totals exceed estimated numbers of disabled people since some people report more than one main cause of disability.

All figures are rounded to nearest 1,000.

Figure 3.3 : Breakdown of grouping VI (diseases of the central nervous system) into specific diseases, with numbers of sufferers, as identified by the Harris study and updated

| A<br>Disease | B<br>No. aged 16 & over living in private households, 1971 | C<br>Total No. in Britain, 1985 |
|---|---|---|
| Poliomyelitis | 38,000 | 49,000 |
| Cerebral haemorrhage, strokes | 130,000 | 169,000 |
| Multiple sclerosis | 24,000 | 31,000 |
| Paralysis agitans (Parkinsonism) | 22,000 | 29,000 |
| Cerebral palsy (spastic) | 15,000 | 20,000 |
| Paraplegia, hemiplegia | 21,000 | 27,000 |
| Epilepsy | 21,000 | 27,000 |
| Migraine | 3,000 | 4,000 |
| Dizziness, convulsions, vertigo | 17,000 | 22,000 |
| Sciatica | 14,000 | 18,000 |
| Head injury | 12,000 | 16,000 |
| Other | 42,000 | 55,000 |

All figures are rounded to nearest 1,000.

Figure 3.4 : Breakdown of grouping VII (diseases of the circulatory system) into specific diseases, with numbers of sufferers, as identified by the Harris study and updated

| A<br>Disease | B<br>No. aged 16 & over living in private households, 1971 | C<br>Total No. in Britain, 1985 |
|---|---|---|
| Congenital heart disease | 2,000 | 3,000 |
| Rheumatic fever | 7,000 | 9,000 |
| Coronary disease, angina | 129,000 | 168,000 |
| Arteriosclerotic diseases | 53,000 | 69,000 |
| High blood pressure, hypertension | 57,000 | 74,000 |
| Diseases of the arteries | 26,000 | 34,000 |
| Varicose veins | 26,000 | 34,000 |
| Unspecified heart trouble | 88,000 | 115,000 |
| Other | 103,000 | 134,000 |

All figures are rounded to nearest 1,000.

Figure 3.5 : Breakdown of grouping VIII (diseases of the respiratory system) into specific diseases, with numbers of sufferers, as identified by the Harris study and updated

| A<br>Disease | B<br>No. aged 16 & over living in private households, 1971 | C<br>Total No. in Britain, 1985 |
|---|---|---|
| Bronchitis | 130,000 | 169,000 |
| Emphysema | 29,000 | 38,000 |
| Asthma | 55,000 | 72,000 |
| Pneumoconeosis, silicosis | 20,000 | 26,000 |
| Other | 50,000 | 65,000 |

All figures are rounded to nearest 1,000.

Figure 3.6 : Breakdown of grouping XIII (diseases of bones and organs of movement) into specific diseases, with numbers of sufferers, as identified by the Harris study and updated

| A<br>Disease | B<br>No. aged 16 & over living in private households, 1971 | C<br>Total No. in Britain, 1985 |
|---|---|---|
| Rheumatoid arthritis | 135,000 | 176,000 |
| Osteo-arthritis | 140,000 | 182,000 |
| Other arthritis | 595,000 | 775,000 |
| Osteomyelitis | 5,000 | 7,000 |
| Slipped disc, lumbago | 65,000 | 85,000 |
| Muscular dystrophy | 8,000 | 10,000 |
| Fractures | 92,000 | 120,000 |
| Sprains, strains, dislocations etc. | 32,000 | 42,000 |
| Other | 115,000 | 150,000 |

All figures are rounded to nearest 1,000.

Figure 3.7 : Age and sex of disabled people, in Great Britain, as identified by the Harris study

| A | B | C | D | E |
|---|---|---|---|---|
| | | | % in each age group who are | |
| Age Group | Estimated No. in GB | No. as % of total disabled | Men | Women |
| 16-29 | 89,000 | 2.9 | 56.2 | 43.8 |
| 30-49 | 366,000 | 11.9 | 53.7 | 46.3 |
| 50-64 | 833,000 | 27.1 | 48.1 | 51.9 |
| 65-74 | 915,000 | 29.8 | 38.9 | 61.1 |
| 75+ | 867,000 | 28.3 | 28.0 | 72.0 |
| Total | 3,070,000 | 100.0 | 50.1 | 49.9 |

N.B. All figures are correct to 1971 and include only those aged 16 or over living in private households.

Figure 3.8 : Mobility of disabled people in Great Britain as identified by the Harris study and updated

| A | B | C |
|---|---|---|
| Degree of Mobility | No. aged 16 & over living in private households, 1971 | Total No. in Britain, 1985 |
| Can get about house only (walking or in wheelchair) | 319,000 | 415,000 |
| Chairfast | 61,000 | 79,000 |
| Bedfast | 28,000 | 36,000 |
| (Total Housebound | 408,000 | 530,000) |
| Can go out on own, no aids or difficulty | 1,637,000 | 2,132,000 |
| Can go out on own, with aids or difficulty | 697,000 | 908,000 |
| Can go out only if accompanied | 329,000 | 428,000 |
| (Total able to go out | 2,663,000 | 3,468,000) |

All figures are rounded to nearest 1,000.

Figure 3.9 : Incidence of Disability in Newcastle upon Tyne, 1983

| | Cause of disability | % of disabled people in Newcastle with disability | Estimated total no. in Newcastle with disability (to nearest 100) |
|---|---|---|---|
| V | Mental, psycho-neurotic and personality disorders | 9 | 1,800 |
| VI | Diseases of central nervous system | 19 | 3,800 |
| VII | Diseases of circulatory system | 26 | 5,300 |
| VIII | Diseases of respiratory system | 17 | 3,400 |
| XI | Diseases of sense organs (including blindness) | 12 | 2,400 |
| XIII | Diseases of bones and organs of movement | 56 | 11,300 |
| XV | Injuries and amputations | 4 | 800 |
| | Other conditions | 13 | 2,600 |

Totals exceed the number of disabled people in Newcastle since some people have more than one disability. Roman numerals in left-hand column refer to groupings according to the International Classification of Diseases, 1959.

Figure 3.10 : Breakdown of Grouping VI (diseases of the central nervous system) into specific diseases with numbers of sufferers in Newcastle upon Tyne, 1983

| Disease | No. of sufferers |
|---|---|
| Cerebral haemorrhage, stroke | 1,550 |
| Multiple sclerosis | 300 |
| Paralysis agitans (Parkinsonism) | 250 |
| Cerebral palsy (Spastic) | 150 |
| Paraplegia, hemiplegia | 150 |
| Epilepsy | 400 |
| Other | 950 |

Figure 3.11 : Breakdown of Grouping VII (diseases of the circulatory system) into specific diseases with numbers of sufferers in Newcastle upon Tyne, 1983

| Disease | No. of sufferers |
|---|---|
| Coronary disease, angina | 3,450 |
| High blood pressure, hypertension | 800 |
| Diseases of the arteries | 650 |
| Other | 400 |

Figure 3.12 : Breakdown of Grouping VIII (diseases of the respiratory system) into specific diseases with numbers of sufferers in Newcastle upon Tyne, 1983

| Disease | No. of sufferers |
|---|---|
| Bronchitis | 1,750 |
| Emphysema | 500 |
| Asthma | 550 |
| Other | 550 |

Figure 3.13 : Breakdown of Grouping XIII (diseases of bones and organs of movement) into specific diseases with numbers of sufferers in Newcastle upon Tyne, 1983

| Disease | No. of sufferers |
|---|---|
| Arthritis | 6,650 |
| Slipped disc, lumbago | 300 |
| Fractures, sprains, etc. | 1,250 |
| Other | 3,150 |

All figures are rounded to nearest 50.

Figure 3.14 : Numbers and ages of disabled people in Newcastle upon Tyne 1972 and 1983

(i) 1972

| Age group | Estimated numbers in City | Numbers as % of total disabled |
|---|---|---|
| 0-14 | 700 | 3.1 |
| 15-44 | 2,100 | 9.6 |
| 45-59 | 4,000 | 18.4 |
| 60-74 | 8,000 | 36.4 |
| 75+ | 7,100 | 32.5 |
| TOTAL | 21,900 | 100.0 |

All figures are rounded to nearest 100

(ii) 1983

| Age group | Estimated numbers in City | Disabled as % of City population in age group | Numbers as % of total disabled |
|---|---|---|---|
| 0-15 | 750 | 1.3 | 3.7 |
| 16-49 | 3,000 | 2.3 | 14.8 |
| 50-59/64 | 4,250 | 10.2 | 21.0 |
| 60/65-74 | 5,250 | 14.8 | 25.9 |
| 75+ | 7,000 | 41.6 | 34.6 |
| TOTAL | 20,250 | 7.5 | 100.0 |

All figures are rounded to nearest 250.

Figure 3.15 : Age and sex of disabled people in Newcastle upon Tyne, 1983

| Age | % of disabled in each age group who are Men | Women | Unspecified |
|---|---|---|---|
| 0-15 | 33.8 | 32.4 | 33.8 |
| 16-49 | 52.0 | 48.0 | - |
| 50-59/64 | 73.4 | 25.5 | 1.1 |
| 60/65-74 | 37.9 | 60.6 | 1.5 |
| 75+ | 26.5 | 72.3 | 1.2 |
| Total | 42.8 | 54.9 | 2.3 |

Figure 3.16 : Household size of disabled people in Newcastle upon Tyne, 1983

| Household size (No.of persons) | % of disabled people in Newcastle living in household of size | % of total population of Newcastle living in household of size |
|---|---|---|
| 1 | 32 | 26 |
| 2 | 44 | 31 |
| 3 | 15 | 17 |
| 4 or more | 9 | 26 |

N.B. 17% of disabled people live in a household containing at least one other disabled person.

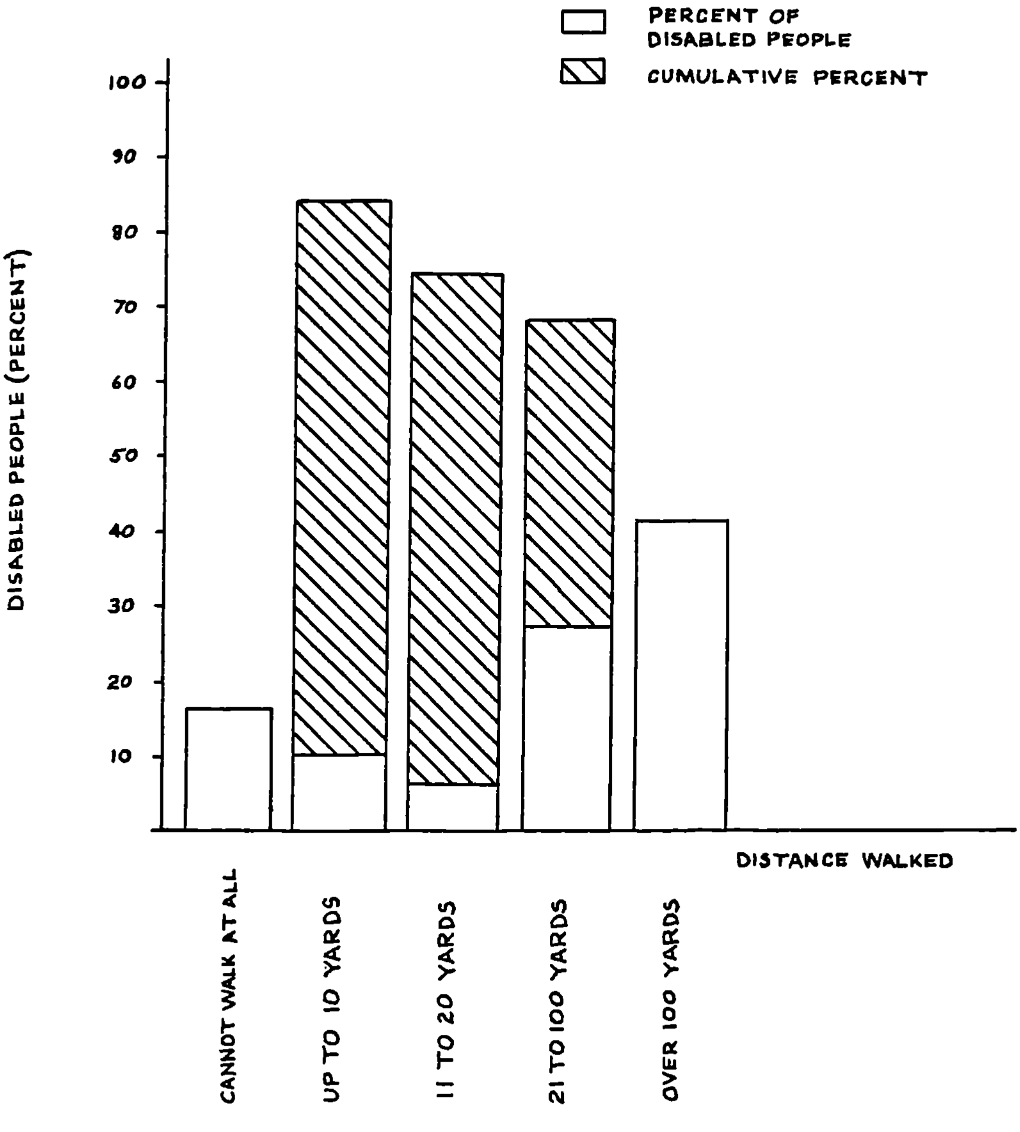
Figure 3.17 : Car ownership and availability among disabled people in Newcastle upon Tyne, 1983

| Category | % of Men | % of Women | % of all disabled |
|---|---|---|---|
| Owns and uses car | 19 | 9 | 14 |
| Household member has car available | 8 | 19 | 13 |
| Relative or friend gives lifts | 11 | 14 | 13 |
| Lift available in case of pressing need | 13 | 17 | 15 |
| No car available | 49 | 41 | 45 |

Figure 3.18 : Percentages of disabled people in Newcastle upon Tyne in 1983 with various degrees of indoor and outdoor mobility

| Degree of Mobility | % of disabled indoors | % of disabled outdoors |
|---|---|---|
| No aids | 55 | 34 |
| Uses furniture for support | 8 | N/A |
| Dizzy and unsteady | 11 | 11 |
| Uses walking aids (excluding wheelchair) | 14 | 20 |
| Needs support from escort | 4 | 19 |
| Uses wheelchair | 3 | 9 |
| Chairbound/bedridden | 5 | |
| Housebound | | 7 |

Figure 3.19(a) : Distance walked outside by disabled people in Newcastle upon Tyne, 1983




Percentage totals refer to percentages of valid and definite responses. They do not include the 7% of respondents who gave vague answers (e.g. "varies", "don't know").

Figure 3.19(b) : Distance walked outside by disabled people in Newcastle upon Tyne, 1983

| Distance walked | % of disabled people | Cumulative percentage |
|---|---|---|
| Cannot walk at all | 16 | - |
| Up to 10 yards | 10 | 84 |
| Up to 20 yards | 6 | 74 |
| 21-100 yards (including those who experienced pain or difficulty) | 27 | 68 |
| Over 100 yards | 41 | 41 |

Percentage totals refer to percentages of valid and definite responses. They do not include the 7% of respondents who gave vague answers (e.g. "varies", "don't know").

Figure 3.20 : Public Transport use by disabled people in Newcastle upon Tyne, 1983

| | % of disabled people using mode | | | |
|---|---|---|---|---|
| Mode | Once a week or more | Once or twice a month | Less than once a month | Never |
| Bus | 40 | 9 | 14 | 37 |
| Metro | 12 | 6 | 14 | 68 |
| BR Train | - | 2 | 14 | 84 |
| Taxi | 3 | 6 | 24 | 67 |
| Social Services Transport | 3 | - | 2 | 95 |
| Ambulance | 3 | 3 | 20 | 74 |
| Community Transport | 4 | - | 2 | 94 |

Figure 3.21 : Percentages of the total population of North Tyneside in 1981 with various diseases as compared to estimates from Harris and the 1983 Newcastle survey

| | % of total GB pop'n with disease, 1985 | % of total Newcastle pop'n with disease, 1983 | % of total NT pop'n with disease, 1981 |
|---|---|---|---|
| Rheumatism and arthritis | 2.1 | 2.5 | 1.1 |
| Disorders of heart | 0.5 | 1.3 | 0.7 |
| Blind/Partial sight | N.A. | N.A. | 0.4 |
| Bronchitis | 0.3 | 0.6 | 0.4 |
| Stroke | 0.3 | 0.6 | 0.4 |
| Paralysis | 0.1 | 0.1 | 0.2 |
| Amputation | N.A. | N.A. | 0.1 |
| Multiple Sclerosis | 0.1 | 0.1 | 0.1 |
| Poliomyelitis | 0.1 | N.A. | 0.1 |
| Parkinsonism | 0.1 | 0.1 | 0.1 |

N.A. = Not available

Figure 3.22 : Age distribution of disabled people and of the total population of North Tyneside in 1981

| | % of people in each age group | |
|---|---|---|
| Age group | Disabled People | Total pop'n |
| 0-14 | 2.6 | 19.2 |
| 15-24 | 2.4 | 15.7 |
| 25-44 | 6.3 | 24.4 |
| 45-64 | 30.7 | 25.4 |
| 65-74 | 29.2 | 9.9 |
| 75 and over | 28.8 | 5.4 |
| Total | 100.0 | 100.0 |

Figure 3.23 : Mobility characteristics of disabled people in North Tyneside, 1981

| Mobility Characteristic | No.of interview respondents in category | % of interview respondents in category | % of total NT pop'n in category |
|---|---|---|---|
| Normally ambulant | 734 | 13 | 0.4 |
| Ambulant but restricted | 3,438 | 59 | 1.8 |
| Ambulant with aid (stick, frame, etc.) | 1,706 | 29 | 0.9 |
| Ambulant only with fitted appliance | 77 | 1 | 0.1 |
| Ambulant only with artificial limb | 56 | 1 | 0.1 |
| Walks but prone to falling | 521 | 9 | 0.3 |
| Walks but needs guiding or personal support | 470 | 8 | 0.2 |
| Walks but cannot sit/stand unaided | 69 | 1 | 0.1 |
| Wheelchair user | 539 | 9 | 0.3 |
| Wheelchair bound | 148 | 3 | 0.1 |
| Bedfast | 44 | 1 | 0.1 |
| Other | 177 | 3 | 0.1 |

Totals exceed the number of disabled people, since respondents were asked to state all categories which applied to them and, therefore, some people stated more than one category. Percentages are rounded to nearest 0.1% and those of less than 0.1% are given as 0.1%.

Figure 3.24 : Difficulties encountered, when going out, by disabled people in North Tyneside, 1981

| Difficulty | % of disabled people in NT |
|---|---|
| Getting in and out of house | 46 |
| As pedestrian | 66 |
| In shops | 48 |
| On public transport | 53 |
| As car driver | 1 |
| As car passenger | 6 |
| As cyclist | 1 |
| As wheelchair user | 6 |
| Severe fatigue | 51 |
| With parking | 1 |
| With toilets | 6 |
| Finding way around | 3 |
| Using guide dog | 1 |
| Emotional problems | 7 |
| Behaviour | 2 |
| Special risk | 13 |
| Other | 2 |

Percentages exceed 100% as respondents could state as many categories as applied to them.

Figure 3.25 : Cause of disability of respondents to North Tyneside wheelchair survey

| Disability | No. of respondents with disability | % of respondents with disability |
|---|---|---|
| Arthritis | 89 | 27 |
| Cerebro-vascular diseases | 63 | 19 |
| Amputation | 35 | 11 |
| Paralysis | 34 | 10 |
| Organic nervous diseases | 32 | 10 |
| Fractures | 27 | 8 |
| Mental handicap | 13 | 4 |
| Cerebral palsy | 7 | 2 |
| Polio | 5 | 2 |
| Other | 4 | 1 |
| Not given | 6 | 2 |

Totals exceed number of respondents as some people gave more than one cause of disability

Figure 3.26 : Age and sex of respondents to North Tyneside wheelchair survey

| Age group | No. as % of w/chr users | % in each age group who are Men | Women |
|---|---|---|---|
| 0-16 | 4 | 50 | 50 |
| 17-29 | 7 | 48 | 52 |
| 30-49 | 11 | 39 | 61 |
| 50-59 | 14 | 38 | 62 |
| 60-64 | 13 | 30 | 70 |
| 65-74 | 24 | 35 | 65 |
| 75 and over | 27 | 17 | 83 |
| Total | 100 | 32 | 68 |

Figure 3.27 : Types of wheelchairs used by respondents to North Tyneside wheelchair survey

| Type of chair | % of total |
|---|---|
| Indoor, electric, rider-controlled | 1 |
| Electric, helper-controlled | 2 |
| Electric, rider-controlled | 4 |
| Electric, type unknown | 4 |
| Sub-total electric | 11 |
| Manual, self-propelled | 49 |
| Manual, pushchair | 33 |
| Manual, type unknown | 1 |
| Sub-total manual | 83 |
| Unknown type | 6 |

Figure 3.28 : Use of different modes of transport by respondents to North Tyneside wheelchair survey and the population of Great Britain

| Mode | Percentage of journey-stages made by mode | |
|---|---|---|
| | NT wheelchair users | Pop'n of GB |
| Walking, inc. wheelchair trips | 27 | 43 |
| Car, lorry, van | 43 | 38 |
| Other private transport (inc. all ambulances, minibuses, voluntary and private hire transport) | 21 | 4 |
| Sub-total private transport | 91 | 85 |
| Rail (inc. Metro) | 2 | 2 |
| Bus | 2 | 12 |
| Other public transport (inc. taxis) | 5 | 1 |
| Sub-total public transport | 9 | 15 |

Figures for GB population are according to Department of Transport (1983)

Figure 3.29 : Use of modes of transport by respondents to North Tyneside wheelchair survey

| Mode | Percent of journey-stages |
|---|---|
| Walking unaided | 2 |
| Walking with aid | 3 |
| Pushed in wheelchair | 17 |
| Self-propelled wheelchair | 3 |
| Electric helper-controlled wheelchair | 1 |
| Electric rider-controlled wheelchair | 1 |
| Household car | 17 |
| Other car | 6 |
| Invalid 3-wheeler | 4 |
| Adapted car | 16 |
| Taxi | 5 |
| Bus | 2 |
| Private hire coach/minibus | 3 |
| Metro | 2 |
| Train | 1 |
| Social Services transport | 13 |
| Voluntary sector transport | 2 |
| Other | 2 |

All figures are rounded up to nearest 1%

Figure 3.30 : Occupation of the PTIS sample population

| Occupation | % of sample pop'n in category |
|---|---|
| Housewife | 16 |
| Under school age | 5 |
| School child/student | 21 |
| Retired | 10 |
| Unemployed | 4 |
| Long-term sick | 2 |
| Part-time employed | 7 |
| Full-time employed | 36 |

Figure 3.31 : Health categories of the PTIS sample population

| Health category | % of sample pop'n in category |
|---|---|
| Difficulty with journeys on foot | 3 |
| Difficulty with journeys by bus | 1 |
| Difficulty with journeys on foot and difficulty with journeys by bus | 3 |
| Housebound | 1 |
| No difficulty (none assumed if none given) | 92 |

Figure 3.32 : Income of elderly and disabled PTIS respondents compared to all PTIS respondents

| Category | % of category with annual household income Under £3000 | £3001 to £6000 | £6001 to £9000 | £9001 and over |
|---|---|---|---|---|
| Aged 65 or over | 74 | 20 | 4 | 2 |
| OAP Permit Holder | 75 | 19 | 5 | 1 |
| Disabled Persons Permit Holder | 50 | 36 | 10 | 4 |
| Long term sick | 58 | 32 | 9 | 1 |
| Retired | 71 | 20 | 6 | 3 |
| Difficulty with foot journeys | 64 | 26 | 7 | 3 |
| Difficulty with bus journeys | 55 | 33 | 8 | 4 |
| Difficulty with foot journeys and with bus journeys | 62 | 28 | 7 | 3 |
| Housebound | 68 | 26 | 3 | 3 |
| Total PTIS sample | 25 | 42 | 23 | 10 |

The above are percentages of valid responses : response rate to this question was about 95%.

Figure 3.33 : Household size of elderly and disabled PTIS respondents compared to all PTIS respondents

| Category | % of category living in households of size 1 person | 2 people | 3 people | 4 or more people |
|---|---|---|---|---|
| Aged 65 or over | 32 | 53 | 10 | 5 |
| OAP Permit Holder | 33 | 53 | 10 | 4 |
| Disabled Persons Permit Holder | 13 | 44 | 21 | 22 |
| Long term sick | 13 | 38 | 22 | 27 |
| Retired | 32 | 53 | 10 | 5 |
| Difficulty with foot journeys | 24 | 46 | 15 | 15 |
| Difficulty with bus journeys | 18 | 36 | 19 | 27 |
| Difficulty with foot journeys and with bus journeys | 28 | 41 | 13 | 18 |
| Housebound | 32 | 43 | 16 | 9 |
| Total PTIS sample | 8 | 25 | 21 | 47 |

Figure 3.34 : Household car availability of elderly and disabled PTIS respondents, compared to all PTIS respondents

| Category | % in category living in households with No car | 1 car | 2 or more cars |
|---|---|---|---|
| Aged 65 or over | 80 | 19 | 1 |
| OAP Permit Holder | 80 | 19 | 1 |
| Disabled Persons' Permit Holder | 74 | 23 | 3 |
| Long-term sick | 75 | 23 | 3 |
| Retired | 77 | 22 | 1 |
| Difficulty with foot journeys | 77 | 20 | 3 |
| Difficulty with bus journeys | 77 | 20 | 3 |
| Difficulty with foot journeys and with bus journeys | 75 | 22 | 3 |
| Housebound | 82 | 16 | 2 |
| Total PTIS sample | 53 | 40 | 7 |

Figure 3.35 : Total trip rates of elderly and disabled PTIS respondents, compared to all PTIS respondents

| Category | Average No. of one-way trips per day |
|---|---|
| Aged 65-70 | 2.2 |
| Aged 71-75 | 1.8 |
| Aged 76 or over | 1.5 |
| OAP Permit Holder | 2.0 |
| Disabled Persons' Permit Holder | 2.0 |
| Long-term sick | 1.7 |
| Retired | 2.0 |
| Difficulty with foot journeys | 2.2 |
| Difficulty with bus journeys | 2.3 |
| Difficulty with foot journeys and with bus journeys | 1.4 |
| Housebound | 0.1 |
| Total PTIS sample | 2.8 |

Figure 3.36 : Estimated breakdown of the numbers of non-housebound disabled people with physical or visual impairment in Tyne and Wear into disability groupings

| Cause of disability | Estimated No.of sufferers in T&W able to go out | Estimated % of disabled people in T&W able to go out, with disability |
|---|---|---|
| Diseases of bones and organs of movement | 33,600 - 37,500 | 56 |
| Diseases of circulatory system | 15,600 - 17,400 | 26 |
| Diseases of central nervous system | 11,400 - 12,700 | 19 |
| Diseases of respiratory system | 10,200 - 11,400 | 17 |
| Injuries and amputations | 2,400 - 2,700 | 4 |
| Visual disabilities | 4,800 - 5,400 | 8 |

All numbers are rounded to the nearest 100.
Percentages exceed 100 since estimates are based on replies to the 1983 Newcastle City survey, in which some respondents named more than one disability.

Figure 3.37 : Estimated age distribution of non-housebound disabled people with physical or visual impairment in Tyne and Wear

| Age group | Estimated No.of disabled people in age group |
|---|---|
| 0-15 | 2,200 - 2,500 |
| 16-49 | 8,900 - 9,900 |
| 50-59/64 | 12,600 - 14,100 |
| 60/65-74 | 15,500 - 17,400 |
| 75 and over | 20,800 - 23,100 |

All numbers are rounded to the nearest 100.

Figure 3.38 : Estimates of sex, household size and household car ownership of non-housebound disabled people with physical or visual impairment in Tyne and Wear

| Category | Estimated No.of disabled people in T&W in category | Estimated % of disabled people in T&W in category |
|---|---|---|
| Males | 25,800 - 33,500 | 43 - 50 |
| Females | 30,000 - 36,900 | 50 - 55 |
| Living alone | 12,600 - 21,400 | 21 - 32 |
| No car in household | 43,800 - 48,900 | 73 |

All numbers are rounded to the nearest 100.

Figure 3.39 : Estimates of the mobility of non-housebound disabled people with physical or visual impairment in Tyne and Wear

| Category | Estimated No.of disabled people in T&W in category | Estimated % of disabled people in T&W in category |
|---|---|---|
| Able to go out alone without aids or difficulty | 22,200 - 41,500 | 37 - 62 |
| Able to go out alone using aids or with difficulty | 15,600 - 28,800 | 26 - 43 |
| Able to go out only if accompanied | 7,200 - 13,400 | 12 - 20 |

All numbers are rounded to the nearest 100.

Figure 3.40 : Estimates of the maximum distances attainable by non-housebound disabled people with physical or visual impairment in Tyne and Wear

| Distance | Estimated No.of disabled people in T&W in category | Estimated % of disabled people in T&W in category |
|---|---|---|
| Cannot walk at all | 9,600 - 10,700 | 16 |
| Up to a few yards | 6,000 - 6,700 | 10 |
| Up to 20 yards | 3,600 - 4,000 | 6 |
| 20-100 yards (including those experiencing pain or difficulty) | 16,200 - 18,100 | 27 |
| Over 100 yards | 24,600 - 27,500 | 41 |

All numbers are rounded to the nearest 100.

Figure 3.41 : Estimated numbers of wheelchair users in Tyne and Wear

| Category | Estimated No.in T & W |
|---|---|
| Wheelchair users | 3,300 - 8,200 (4% to 9% of disabled people) |
| Housebound wheelchair users | 500 - 1,200 (15% of wheelchair users) |
| Wheelchair users confined to wheelchair outdoors | 2,600 - 6,300 (77% of wheelchair users) |

All numbers are rounded to nearest 100.
Note that categories two and three are _not_ mutually exclusive.

# CHAPTER 4 :

# THE USE OF METRO

# BY DISABLED PEOPLE

## 4.1 Introduction : surveys of the use of Metro by disabled people

The aim of this Chapter is to ascertain the use made of Metro by disabled people and to this end, the results of the following are given:

i) Several surveys of the use of lifts, ramps and wide barriers (the main facilities for disabled people) at Metro stations, some of which were carried out by Tyne and Wear PTE while others were conducted especially for this thesis;

ii) A questionnaire survey of disabled people, including both users and non-users of Metro, undertaken specifically for this thesis;

iii) Visits to Metro by disabled people and discussions with interested individuals and groups;

iv) The report on the survey of disabled people by the City of Newcastle upon Tyne (1985), which is also discussed in Section 4 of Chapter 3;

v) Relevant parts of the survey of wheelchair users in North Tyneside (see Section 6 of Chapter 3);

vi) The reports by Manook et al (1978) and by Robinson and Porter (1981).

Thus, although analysis will be given of other studies concerning the use of Metro by disabled people, a variety of surveys, visits and discussions were undertaken especially for this thesis and the results of these will form the bulk of the material presented in this Chapter.

## 4.2 Surveys of the numbers of disabled people using Metro

Probably the best way of determining the number of disabled people using Metro is to carry out a series of counts of the users of lifts, ramps and wide barriers at stations. Although some disabled people may use the system without recourse to any of these facilities, it is safe to assume that the numbers of such people are likely to be small and that the vast majority of disabled people who travel by Metro will use at least one of these three facilities at some stage.

Tyne and Wear PTE carried out a one-day count of lift users at Monument station in November, 1983, as part of a series of general surveys of the numbers of all people using Metro. The numbers and types of people entering and leaving the main lift were recorded, at concourse level and also at East-West platform level (but not at North-South platform level). The results, together with times and dates of the counts are given in Figures 4.1 and 4.2 - the times over which counts were made can be taken as approximations of a whole day, since passenger flows early in the morning and late at night are relatively light. Although counts were taken only of users of the main lift and at only two of the three levels served by this lift, it can be assumed that few passengers would use the street to concourse lift and not the lift between concourse and platform levels, while use of the latter lift between any two levels would result in the user being counted in the survey. The opposite problem, double counting, arises since anyone travelling by lift between the two levels at which counts were taken will appear on each count, while a person travelling between either of the two levels surveyed and the North-South platform level will appear only once.

Even a cursory glance at these results reveals that the majority of lift users were not disabled. At concourse level, disabled people, including the elderly, accounted for 175 or about 35% of lift users, while at East-West platform level only 49 lift users were disabled and/or elderly - about 18% of the total. It would be incorrect to claim that these non-disabled people were making unnecessary use of the lifts since many would have equally genuine reasons for changing levels by this means. No explanation, however, can be offered for the difference, between the two levels, in the percentages of users who were disabled. Among disabled lift users, the majority fell into the category of "Other Disabled", which comprised all ambulant disabled and elderly people. Visually impaired people accounted for nearly 2% of disabled lift users at concourse level and also about 2% at East-West platform level, while wheelchair users comprised 13% and 35% of lift users at these two levels respectively. Since the surveys analysed in Chapter 3 indicate that approximately 8% of all disabled people are visually impaired and between 4% and 9% use a wheelchair, it seems that visually impaired people are under-represented and wheelchair users are over-represented among lift users on Metro. A plan showing the layout of Monument station is given in Appendix I.

This survey, of one station on one day only, is for several reasons somewhat inadequate for the purposes of this thesis. Monument may not be typical of the whole system as regards lift use or use by disabled people; there was no information on the total numbers of people using Monument station on the day in question; no count was made of the numbers and types of people using the wide barrier; no counts were made of ramp use at stations with ramps instead of lifts;

and use on this particular day may not be typical of use on other days. Accordingly, a series of counts at various stations at different times of day was undertaken during June, 1984. The results can be compared with a one-day annual count of total boardings and alightings at all Metro stations carried out about a month before, on 22nd May, 1984, by Tyne and Wear PTE as part of the Metro Monitoring and Development Study, undertaken in conjunction with Tyne and Wear County Council, the Transport and Road Research Laboratory and the University of Newcastle upon Tyne. This comparison will enable estimates to be made firstly of the percentage of Metro users (whether disabled or not) who use the facilities for disabled people and secondly of the percentage of Metro users who are actually disabled and use these facilities. These percentages can then be applied to figures for total annual Metro ridership, which according to Tyne and Wear PTE (1986) was 61 million in 1984/85, to give estimates of the total annual and weekly numbers of disabled Metro users and of all Metro passengers using the facilities for disabled people.

Figure 4.3 gives details of the times and locations of the various counts made during June, 1984 and of the particular facilities at each station. Plans of station layouts are given in Appendix I. Concessionary Travel Permits are only valid on weekdays between 0930 hours and 1600 hours and after 1800 hours and as it was assumed that most disabled people would be travelling on a Permit, counts were only made during these hours. It should be noted that any Metro passenger can use lifts and ramps at stations, but passes to use the wide barriers are only issued to certain categories of people, mainly those with prams and pushchairs, staff, wheelchair users and blind people. In the two latter cases, the facility to open the wide barrier is normally incorporated into the electronically coded information on the Concessionary Travel Permit. Ideally, a large number of counts would have been made at numerous stations over several days, but financial constraints necessitated reliance on voluntary survey staff so that only a small number of people were available.

Survey staff were instructed to record the number of people using the lifts, ramps or wide barriers as appropriate and to classify each user, by observation only. Note was taken of the direction of travel of each user. The duration and nature of any malfunction of lifts or wide barriers was also noted. Figures 4.4, 4.5 and 4.6 give the results of all the counts taken together of lift use, wide barrier use and ramp use respectively. Before detailed analysis is given, a number of difficulties which were encountered need to be discussed.

Firstly, it was realised that classification by observation could lead to inaccuracies: no interviews were carried out in order to avoid embarrassment to both survey staff and passengers. However, some people might not seem to be disabled but would nevertheless genuinely need to use the lift rather than stairs or an escalator. The category "Encumbered by luggage, shopping" is also a subjective classification and staff were told only to record people as such if their progress was actually impeded by bags, packages or other luggage. Secondly, there was the question of how to count people using wide barriers which had been jammed open. Figure 4.7 gives details of cases where this occurred. Survey staff were instructed that in such an event, able-bodied or apparently able-bodied people using wide barriers should not be counted, on the grounds that they would probably not have used the wide barriers had they been functioning properly. However, during such times, blind people, people in wheelchairs, those with prams or pushchairs and staff were still counted, provided of course that they used the wide barrier. Thirdly, a similar problem arose of how to record unsuccessful attempts to use inoperative lifts. If the lift failed during a survey, a note was made of the duration and nature of the failure and it was decided to record all unsuccessful attempts to use the lift in such cases. However, since staff were usually positioned at one level only, unsuccessful attempts to use the lift at the other level could not be recorded. Figure 4.7 also gives details of the duration and nature of lift failures and it should be noted that reliability both of lifts and wide barriers seemed good, although the sample size, in terms of the total time during which observations were made, is quite small. Lifts were operative for about 97% of the time over which observations were made and wide barriers for 89%, but all the wide barrier failures consisted of the barrier being jammed open, so that the wide barriers were passable for 100% of the survey time. During periods of lift malfunction, only about a dozen people were seen to try to use the lift. All of these were able to use the escalator or stairs, although this would not have been the case if a wheelchair-bound person had arrived at such a time.

The main point to emerge from the surveys of lift and wide barrier use was that the majority of passengers making use of these facilities were not in fact disabled. Obviously-disabled people accounted for about 19% of lift users and about 11% of wide barrier users. Of the lift users, the two "No Obvious Difficulty" categories together formed the largest group: out of 1,491 lift users, approximately 32% were adults with no obvious difficulty and about 8% were children with no obvious difficulty. People with prams or pushchairs comprised about 30% of lift users, those encumbered with luggage or shopping about 6% and staff and others about 4%. Of the 287 disabled lift users (19% of all lift users), just over 9% were in wheelchairs, about 4% were visually impaired and the remaining 87% were ambulant disabled people. Most of the last-named category were in fact frail elderly or others without either an aid or escort. As explained above, it is probable that some of the 596 lift users with no obvious difficulty did in fact have a genuine reason for using the lift which might not have been apparent to an observer, for example heart trouble, respiratory problems or vertigo. Moreover, it is almost impossible to calculate the extent to which "target" groups were inconvenienced in their use of the lifts by others. No clear picture emerges as to whether these 596 people constituted "misuse" of the lifts and no deliberate acts of vandalism were seen by survey staff, although the presence of the latter could have deterred would-be vandals.

Turning to the figures for wide barrier use, it was expected that there would be very few ambulant sighted disabled people and "others" using the wide barriers since, as already explained, the facility to open the wide barriers is usually made available only to visually impaired persons, wheelchair users, staff and people with prams or pushchairs. The largest category, as expected, was that of passengers with prams and pushchairs, who accounted for 78% of users. Disabled people comprised 11% and staff a further 4%, while there were 46 "others", or about 7% of the total - a surprisingly large number. None of these had any obvious problem, so it must be assumed that they were somehow in possession of a pass or permit to open the wide barrier, although the reason for preferring this to the turnstile barriers remains obscure, since the latter take less time to negotiate. The composition of disabled wide barrier users was as follows: out of 72 passengers in this category, 23 (or about 32%) were people in wheelchairs, four (or about 6%) were visually impaired, while 45 (or about 62%) were ambulant disabled. Again, the question arises of how these ambulant disabled people obtained wide barrier passes.

With regard to the use of ramps, it should be noted from Figures 4.3 and 4.6 that the counts of ramp users were on a much smaller scale, involving only three stations and a total of 15 hours of observation. The layouts of the three stations surveyed are given in Appendix I and it will be seen that each of the three stations has a different layout as regards ramps and stairs. Overall, out of 550 ramp users, only 12, or about 2% of the total, were disabled in some way. The largest user group was non-disabled children (approximately 78% of the total) while people with prams and pushchairs accounted for 17% of users.

As mentioned earlier, these surveys were carried out about a month after a one-day count of boardings and alightings at all stations was undertaken by Tyne and Wear PTE. The results of the latter were therefore compared with the surveys of lift, wide barrier and ramp use to give estimates firstly of the percentage of Metro passengers using the facilities for disabled people and secondly of the percentage of all Metro users who were actually disabled and required these facilities. In order to do this, the part-day counts of lift, ramp and wide barrier use had to be factored up to give all-day totals. It was assumed that all disabled Metro passengers would use at least one of these facilities. The one-day boarding and alighting count showed that on the day in question (22nd May, 1984) a total of 304,360 boardings and alightings were made. Provided that every Metro passenger was counted both on boarding and on alighting, the total number of people using Metro on that day was half of 304,360, i.e. 152,180.

With regard to the question of how to factor up part-day figures to give all-day totals, the only all-day counts of lift users were those carried out at Monument in November, 1983 (described above). These could not be compared with the all-day boarding and alighting counts undertaken in May, 1984 because of the overall increase in Metro patronage in the intervening period, especially taking into account the opening of the Heworth - South Shields section in March, 1984. However, the June, 1984 surveys included a count of lift users (at all three levels of the main lift) at Monument between 0930 hours and 1230 hours on one of the survey days. Since the November, 1983 results could be disaggregated according to time of day, the percentage of total lift users who were recorded between 0930 and 1230 was ascertained and the June, 1984 result factored up by this proportion. Accordingly, the June, 1984 figures for the North-South and East-West platforms only were taken as corresponding to the boarding and alighting counts (since boarding and alighting counts were made at the two platform levels but not at the concourse) and factored up: this method showed that about 2% of all those boarding and alighting used the lift. The results of the counts at other stations and other times of day were factored up in the same way, i.e. according to the percentage of lift users recorded during the appropriate time in the all-day count. Thus, the results of counts made between 0930 and 1230 hours were multiplied by three, those made between 1300 and 1600 hours were multiplied by four, and between 1800 and 2000 hours by 20. When all the results had been factored up, the total estimates of lift users over the whole day were compared with the known total number of passengers boarding and alighting at all the stations at which lift usage counts had been made. On this basis, it emerged that, at stations with lifts, about 3% of passengers made use of them, a figure quite close to that of 2% arrived at for Monument. It is therefore probably safe to estimate that, at stations with lifts, between 2% and 3% of passengers actually use them. An estimate of the annual and weekly numbers of people using lifts can be made as follows:

i) The May, 1984 one-day boarding and alighting counts showed that, of 304,360 boardings and alightings, 182,190, i.e. nearly 60%, were made at stations with lifts;

ii) Tyne and Wear PTE (1986) state that total annual Metro ridership was 61 million passengers in 1984/85. If it is assumed that 60% of these used stations with lifts, the resultant figure is 36.6 million;

iii) Assuming that, at stations with lifts, between 2% and 3% of these 36.6 million passengers actually used the lifts, total lift usage in 1984/85 was about 732,000 to 1,098,000 per year or approximately 14,000 to 21,000 per week.

Figure 4.8 gives the total of 14,000 to 21,000 broken down by category of user, according to the proportions of each category as shown in Figure 4.4.

Having factored up the results of the lift use survey, the same can be done for the surveys of ramp and wide barrier use. Taking the ramp use counts first, it should be remembered that at some stations, access to platforms is by ramp only as there are no stairs (see Appendix I for plans of all stations). It would therefore be more correct to think in terms of the number of people who would always use a ramp even if stairs were also available. All the counts of ramp use undertaken in June, 1984 were carried out at stations which have steps as well as ramps, but when factoring up, the above point needs to be borne in mind. Since no all-day counts of ramp use are available, the part-day ramp use counts were factored up to give estimates of all-day usage at these stations, using the same proportions as those employed when the lift use surveys were factored up. Obviously, since a relatively small number of ramp use counts were made, the results of this exercise should be treated with some caution. One of the ramp use surveys (that at Wallsend) was undertaken at one platform face only, so due allowance was also made for this factor. It emerged that, at stations with ramps, about 15% of all passengers would choose or require to use the ramps even when stairs were also available. This figure was somewhat higher than the estimate that, at stations with lifts, 2% to 3% of passengers would use the lifts. The discrepancy may be due to the fact that at many stations with both ramps and stairs, the ramp is as convenient a means of changing levels as the steps, whereas at stations with lifts, the lifts are usually less convenient than the escalators or stairs as well as being more obviously "set aside" for the use of disabled people and other specific groups. If the same method is followed for ramp usage as for lift usage, the calculation will be as follows:

i) The May, 1984 boarding and alighting counts showed that, of 304,360 boardings and alightings, 122,170, i.e. 40%, were made at stations with ramps;

ii) Tyne and Wear PTE (1986) state that total annual Metro ridership was 61 million passengers in 1984/85. If it is assumed that 40% of these would use stations with ramps, the resultant figure is 24.4 million;

iii) Assuming that, at stations with ramps, 15% of these 24.4 million passengers actually used the ramps even when stairs were also available, the total number of people using ramps even when stairs were also available was 3,660,000 per year or 70,000 per week. Figure 4.9 gives this total of 70,000 broken down by category of user, according to the proportions of each category as shown in Figure 4.6. Since these estimates are factored up from a rather narrow base, they should be treated with some caution: it is unwise, for example, to conclude that no visually impaired people would require to use ramps at stations so equipped.

An estimate of the total number of disabled people using the lifts and ramps on Metro can thus be made by combining the numbers of disabled lift users in Figure 4.8 and the number of disabled ramp users in Figure 4.9. Alternatively, the total number of disabled Metro users could be calculated on the basis of wide barrier use. The part-day counts of the numbers and categories of people using wide barriers carried out during June, 1984 were firstly factored up to give all-day totals, using the same factors as given above for the estimates of lift usage and secondly compared with the May, 1984 boarding and alighting counts. According to these calculations, 2% of all Metro passengers used the wide barriers (which are provided at all stations). According to Tyne and Wear PTE (1986) total annual Metro ridership was 61 million in 1984/85. If it is assumed that 2% of these would use the wide barriers, the resultant figure is 1,220,000 per year or slightly over 23,000 per week. Figure 4.10 gives this total of 23,000 broken down by category of user, according to the proportions given in Figure 4.5. The figure shown for ambulant disabled people is probably an under-estimate of the total number using Metro since passes to open the wide barriers are not usually issued to such individuals.

Figure 4.11 gives estimates of the total number of disabled people using Metro per week, based on a combination of the numbers of disabled people using lifts, ramps and wide barriers. Column B of the table shows estimates based on the figures for lift usage added to those for ramp usage, while Column C gives estimates based on wide barrier usage only. As stated earlier, the number of ambulant disabled people using the wide barriers is probably an under-estimate of the total number of such individuals using Metro so that the "best" estimate given in Column D for ambulant disabled people is based only on lift and ramp usage figures. According to these estimates, a total of between 3,900 and 5,600 disabled people use Metro per week, or approximately 203,000 to 292,000 per year. This represents roughly 0.3% to 0.5% of the 61 million Metro passengers per year in 1984/85.

Having estimated the number of disabled people using Metro per week and per year, it is also possible to calculate the likely total number of Metro passengers, whether disabled or not, who use the facilities for disabled people. To recapitulate, the following estimates were made earlier in this Section:

i) At stations with lifts, between 2% and 3% of passengers used lifts. About 36.6 million passengers per year used these stations, so actual lift usage in 1984/85 was between 732,000 and 1,098,000 per year or 14,000 to 21,000 per week;

ii) At stations with ramps, about 15% of passengers used ramps even when stairs were also available. About 24.4 million passengers used these stations, so in 1984/85, the number of passengers choosing to use ramps even when stairs were also available was 3,660,000 per year or 70,000 per week;

iii) About 2% of all Metro passengers used the wide barriers at stations all of which are so equipped. Given a total annual Metro ridership of 61 million in 1984/85 this amounts to 1,220,000 per year or 23,000 per week.

It would therefore be possible to arrive at an estimate of the number of passengers using the facilities for disabled people either by combining the lift and ramp usage figures or by relying solely upon wide barrier usage figures. The latter would probably be an under-estimate of the total number of passengers using the facilities for disabled people since the issue of wide barrier passes is limited to certain specific groups. On the other hand, the former would probably be an over-estimate because it is partly based on ramp usage figures and, as already mentioned, the situation at stations with ramps is a little different from that at stations with lifts. Some of the stations with ramps do not have any stairs at all so that all passengers have to use the ramps, but the estimate of 3,600,000 in (ii) above is intended only to include those who would use ramps even when stairs were available. However, this estimate may still be rather high since, as also mentioned earlier, the layout of some stations is such that it may be as convenient to use ramps as to use stairs. In contrast, at stations with lifts, use of these generally involves a more circuitous route and the lifts tend to be seen as being reserved for the use of disabled people and other specific groups.

If the ramp usage estimates are discarded, then the alternatives are either to use the wide barrier usage figures or to factor up the lift usage figures to give an all-system estimate. It was calculated that about 2% of all Metro passengers used wide barriers, according to (iii) above, so that with a total annual Metro ridership of some 61 million in 1984/85, about 1,220,000 people used the wide barriers per year at that time. Alternatively, according to lift usage figures, about 2% to 3% of passengers at stations so equipped used lifts. If these percentages are applied to the figure for total annual Metro ridership in 1984/85, the resultant estimate is 1,220,000 to 1,830,000 (the lower of these two figures is the same as that based on wide barrier usage). Consequently, it would seem appropriate to give the total number of all Metro passengers using the facilities for disabled people as 2% to 3% of ridership, i.e. about 1.2 million to 1.8 million per year in 1984/85.

All the estimates compiled in this Section have been factored up from quite a narrow base. Moreover, the numbers of disabled people are quite small so that even a minor daily variation could have a significant effect when factored up. It was therefore decided to conduct another series of surveys, this time to assess the likely daily variation in the numbers of disabled people using Metro. Due to financial and other constraints, it was possible to make counts at one station only and Gateshead was chosen since it is heavily-used and has a good overall "mix" of users. A record was accordingly made of the numbers and categories of people using the lift and wide barrier between 0930 and 1230 hours every day during the week Saturday, 10th August to

Friday, 16th August, 1985, inclusive. No ramp counts were made since Gateshead does not have this facility. The surveys conducted in June, 1984 and analysed earlier in this Section suggest that at stations with lifts, about 2% to 3% of passengers use them while at stations with ramps about 15% of passengers use this method. However, as stated above, this difference is largely due to the fact that greater numbers of non-disabled people use ramps than use lifts. It can thus be assumed that most of the people who use lifts (at stations with lifts) will also require to use ramps at stations so equipped. In any case, the aim of the surveys carried out at Gateshead was to gain some idea of the likely daily variation of disabled Metro users and it was not primarily a survey of all people using the lift or wide barrier, although the numbers of non-disabled passengers doing so are given.

The total numbers of different categories of people using the wide barrier at Gateshead on each day of the surveys, plus totals and averages, are given in Figure 4.12 and the same results for lift use are shown in Figure 4.13. Two points need to be made regarding overall figures. Firstly, the number of lift users is much greater, in fact by more than three times, than the number of wide barrier users, but this is to be expected since, as previously mentioned, anyone may use the lifts while wide barrier passes are only issued to certain groups of people. A similar trend was also observed during the June, 1984 survey, though not to the same extent. Secondly, and again as noted during the surveys in June, 1984, by no means all wide barrier or lift users were disabled. The Gateshead surveys indicated that only 12% of wide barrier users were disabled (most of the remainder were individuals with prams or pushchairs) while 55% of lift users were disabled (the other 45% being mainly people with prams or pushchairs and non-disabled adults and children). This compares with the June, 1984 survey results which suggested that 11% of wide barrier users and 19% of lift users were disabled, so the figures for the two surveys compare well as regards wide barrier users but not very well in relation to lift users. The principal objective of the Gateshead surveys, however, was to examine the likely daily variation in the number of disabled people using the lift and/or wide barrier and hence using Metro. With regard to wide barrier use by disabled people of all categories, the daily total varied between two on Sunday and 14 on Friday. If the figures for Sunday are ignored, the next lowest figure was three (on Monday). The total number of disabled lift users varied between 21 on Sunday and 187 on Thursday, or from 136 (on Tuesday) to 187 if the Sunday total is ignored.

Although it would be possible to attempt to convert the Gateshead survey results into all-day and system-wide estimates of the numbers of disabled people using Metro, it is probably wiser to rely on the June, 1984 surveys for this purpose. As already stated, the intention behind the Gateshead surveys was only to assess the likely daily variation in both total lift and wide barrier usage and in the use of Metro by disabled people. Figures 4.12 and 4.13 show that, except for Sunday, there was little daily variation in either total lift and wide barrier usage or in numbers of disabled people. Consequently, the Gateshead surveys do not appear to suggest any need to alter the estimates given in Figure 4.11 of the total number of disabled people using Metro per week.

With regard to the relative proportions of different categories of disabled Metro users, Figure 4.11 shows that of the 3,900 to 5,600 disabled people using Metro per week, 18% to 20% were wheelchair users, about 4% were visually impaired and 76% to 78% ambulant disabled. In Figure 4.14, these percentages are compared with the percentages of all disabled people in these categories, as shown in Chapter 3. These comparisons appear to indicate that, among disabled Metro users, wheelchair users were "over-represented" while both visually impaired and ambulant disabled people were "under-represented". The discrepancy in the case of ambulant disabled people may be because some individuals in this category who would be regarded as disabled do not in fact use the facilities provided for them on Metro. This might contribute to "over-representation" of wheelchair users on Metro. The low percentage of visually impaired Metro users is less easily explained but may well be due to the fact that the facilities for disabled people on Metro do not include much provision for those with visual difficulties.

Earlier in this Section, it was estimated that between 0.3% and 0.5% of all Metro passengers were disabled and required to use the facilities on Metro. This estimate can be compared with the incidence of disabled people in the population as a whole. According again to the surveys described in Chapter 3, an estimated 5% to 6% of the Tyne and Wear population of about 1,140,000 are disabled but can go outdoors. Somewhat less than half that percentage, about 2.2% to 2.4% of the Tyne and Wear population, are disabled but can go outdoors and travel for more than 100 yards, with assistance if necessary: this latter group will probably be the most likely, among disabled people, to use Metro. Although this figure of 2.2% to 2.4% is much lower than the estimated 7% of the population who are disabled in some way (including housebound people and those who do not go out very far or very often), it does seem that disabled people are "under-represented" among Metro users.

The author is well aware that the survey results described in this Section are very approximate estimates and that a greater number of surveys would enable calculations to be made with more certainty. However, the use to which this information will be put should be borne in mind. Chapter 6 contains an economic evaluation of the facilities for disabled people on Metro, as a result of which the cost-effectiveness of these facilities can be assessed. This will involve calculating the total expenditure upon the facilities for disabled people (which in some cases is difficult to identify and separate from other expenditure) and working out the Net Present Value of these facilities, i.e. assessing the value of likely future benefits, discounting this back to the present and offsetting it against expenditure. While these calculations are potentially very useful, Chapter 6 will include a discussion of the techniques used and, in this discussion, the limitations of the data and of the techniques will be outlined. Consequently, it would seem that any use of statistical tests in order to arrive at a more "accurate" estimate of the number of disabled people using Metro might run the risk of ascribing spurious accuracy to one set of data to be used in calculations with other data which simply represent the best available information which can be used. This is not an attempt to denigrate the value of the techniques which will be used in Chapter 6 to calculate the cost-effectiveness of the facilities for disabled people, nor is it simply an attempt to avoid subjecting survey results to closer scrutiny. Given the limited resources available, it is doubtful whether further surveys on the scale of those already carried out would have made the accuracy of the results any more certain and the calculation of the cost-effectiveness in Chapter 6 will try to take account of the limitations of both data and technique by calculating cost-effectiveness for a range of usage levels based on the estimates provided by the surveys analysed in this Section.

## 4.3 Results of a questionnaire survey of disabled people

According to the counts of disabled peple using Metro which are analysed in the previous Section, only about 0.3% to 0.5% of all Metro passengers are disabled. Moreover, the survey of disabled people carried out by the City of Newcastle upon Tyne (1985) which is described in Section 4 of Chapter 6 suggests that only about a third of disabled people have used Metro at all. Simple counts of disabled Metro users cannot reveal the reasons for low usage of the system by such individuals, while interviews of disabled people on trains or at stations would only cover the minority of disabled people who travel by Metro. Although it was suspected that low Metro use by disabled people was at least partly due to their proven poor overall mobility, there was no indication of the extent to which this might be the case, nor could any specific problems relating to Metro be identified. It became clear that some kind of general questionnaire survey of disabled people, both users and non-users of Metro, would have to be undertaken. Such a survey would, it was hoped, reveal the factors which prevented more disabled people from using the system, while those who had travelled by Metro could be asked to give their opinions concerning the specific facilities on the system.

Ideally, a list of addresses of disabled people would have been obtained and a random sample selected from this list for either interviews or a postal questionnaire. Indeed, as described in Section 6 of Chapter 3, an address list of wheelchair users had been obtained, from North Tyneside Metropolitan Borough Council, by the University of Newcastle upon Tyne in connection with the CR6 taxi project. Further use of this address list would have necessitated obtaining permission from the Borough Council for which a fee would have been charged. Similarly, it would have been possible to approach Newcastle upon Tyne City Council with a request to use the list of addresses of disabled people identified by their survey, but again this would have involved payment of fees had permission to use the list been granted. In any case, taking names from a list would then have necessitated postal contact to arrange interviews or send self-completion questionnaires.

Given the above constraints, it was decided that the best means of carrying out the survey would be to contact a variety of disabled peoples' clubs, day centres and other groups, as well as Local Authority Social Services Departments, and ask those in charge either to distribute questionnaires or for permission to conduct interviews at some central point, such as a day centre or club meeting. Contact with a number of such bodies had already been made in connection with this thesis so that in many cases it was simply a question of following up already established links. At this stage, it was regretfully decided that interviews could not be conducted as these would be very time-consuming and sufficient manpower resources were not available. A self-completion questionnaire thus emerged as being the most cost-effective survey method, given constraints on manpower and finance.

Lists of voluntary groups were then obtained and the procedure followed was to contact (or follow up previous contact with) the group concerned, describe the project being undertaken and the details of the survey and request assistance. The questionnaires were then usually sent in bulk to those organisations who agreed to co-operate, distributed to disabled people and, when complete, returned either in bulk or singly in reply-paid envelopes by the respondents themselves. The aim was to maximise both distribution of questionnaires and response rates by ensuring that those who agreed to help were involved in as little expense as possible while minimising postage costs wherever practicable.

A total of 644 questionnaire forms were distributed, of which 206, or nearly 32%, were returned with at least 20 of the 26 questions answered. It was decided that any forms not completed beyond the first page or so would be discarded, but in the event, there were only one or two such cases. While the response rate of 32% might seem rather low, standard works on survey technique such as Moser and Kalton (1979) suggest that postal and other self-completion questionnaires often have a lower response rate than those involving interviews and in some cases response rates may be as low as 10%. The same sources indicate that response rates will be particularly low if the sample population contains above average numbers of female and/or elderly people and in this case the sample population was indeed largely elderly and mainly female. In addition, some disabled people may dislike giving information about their conditions, or be so disabled as to be incapable of filling in a form. Consequently, the response rate of 32% is relatively high, given the circumstances. Figure 4.15 gives descriptions (but not names) of the organisations participating in the survey, together with numbers of questionnaires sent and the response rate. Enclosing reply-paid envelopes with the forms did not necessarily result in a higher response rate, nor was there any correlation between response rate and the number of forms distributed. Those groups which did not return any of their questionnaires were contacted repeatedly in an attempt to secure the receipt of even a few completed forms, but without success. The process of contacting organisations began in April, 1984, while distribution and return of questionnaires commenced in May of that year and continued until January, 1985.

A number of points require to be made concerning the survey before commenting on the results. Firstly, there is a strong probability that Metro users will be over-represented since many disabled people who had not used Metro may not have bothered to complete the questionnaire in the belief that it did not apply to them. When the initial approach was made to the various organisations, it was stressed that replies from non-users were just as important as comments from those who had been on the system and as Figure 4.16 indicates, the instructions on the questionnaire included the request that the recipient complete the form whether or not he or she had used Metro. However, some of the organisations concerned did not seem to grasp the fact that non-users as well as users of Metro were to be included in the distribution and completion of questionnaires, even though this had been emphasised repeatedly. Consequently, it cannot be assumed that the percentage of respondents who had used Metro was an accurate indication of the total percentage of disabled people who had been on the system.

A second problem arises out of the method of distribution of forms. Many were sent to groups dealing with specific disabilities or illnesses so that the 206 respondents should not be seen as a representative sample of disabled people but rather as "blocks" of individuals with various disabilities. There is no guarantee that each disability is represented among respondents in the same proportion as the incidence of that disability among the population as a whole. However, the surveys which are analysed in Chapter 3 can be used as "controls" against which the characteristics of the 206 respondents can be compared.

Thirdly, there is the possibility of bias due to "group dynamics" or other problems arising out of the fact that the questionnaires were completed under circumstances which could not be controlled. For example, forms sent to a particular club for disabled people might be filled in at a meeting of that club and discussed during the process of completion so that each individual's responses may have been influenced by those of others. Similarly, those in charge of groups participating in the survey might have transmitted their own opinions, however unintentionally, to those actually answering the questionnaires. This would especially be the case if respondents needed assistance with completion of the forms.

Fourthly, it is quite likely that disabled people who join self-help or social clubs, or who are in contact with charitable bodies or Local Authority Social Services are not representative of disabled people as a whole. On the one hand, it could be argued that the members of a social club for disabled people are probably more outgoing and active than the majority of such individuals, so that their mobility and Metro use will be higher than average for disabled people. Alternatively, those who are in contact with charitable organisations and Social Services might be the most needy and severely disabled individuals in society, so that their mobility and Metro use will be lower than that for most disabled people.

Figure 4.16 contains a copy of the questionnaire form, with the answers to the multiple-choice questions inserted in the form of percentages of valid responses. Answers to the questions inviting comments are given later in this Section and in Chapter 5. In retrospect, a number of questions proved not to yield useful results.

Names and addresses (or post codes) were requested in the hope that respondents' homes and distances from the nearest Metro station could be plotted on a map so that use of the system and comments thereon could be compared with location and distance to Metro stations. However, this exercise proved to be of doubtful value and was not undertaken. Had the respondents not been asked for their names and addresses, the response rate might have been higher due to greater anonymity of replies, but the request for names and addresses did provide a useful cross-check against someone filling in two forms - this was found to have occurred in one or two instances. The questions on whether respondents were registered disabled, blind or partially-sighted and whether respondents were in receipt of Mobility Allowance did not provide insight into Metro use and with hindsight their inclusion may have been unwise. Inevitably, the response rate to individual questions tended generally to decline as the questionnaire progressed. Responses to question 22, on whether those who had used Metro found particular aspects easy, difficult or neither, were rather disappointing. Given that 64% of respondents said they had used Metro, it would be expected that at least 36% would not answer any of the questions on whether particular aspects of the system were easy or difficult, on the grounds of lack of experience. In fact, 91 respondents, or 44% of the total, did not answer any of these questions while the remaining 115 or 56% answered at least one question. Response rates for individual questions varied from 43% ("Using the ticket machines") to 53% ("Using the ticket barriers" and "Getting to the Metro station"). The question on journey purposes during an average week elicited such a poor response that no results are given.

It should be remembered that the respondents to this survey were not expected to be a representative sample of disabled people in Tyne and Wear. However, the survey respondents, as a whole, can be compared with the estimates of the numbers and characteristics of disabled people in Tyne and Wear, as presented in Section 8 of Chapter 3. Figure 4.17 gives a summary of the main characteristics of the 206 questionnaire respondents as compared to the estimates for disabled people generally. There are far fewer young disabled people among the questionnaire respondents than among disabled people generally, while middle-aged disabled people are over-represented and older disabled people are slightly under-represented. The 206 questionnaire respondents also contain a disproportionately low percentage of men. It was found that nearly 37% of questionnaire respondents lived alone compared to an estimate of between 21% and 32% of disabled people generally, while 85% had no household car, as against 57% to 76% of all disabled people. This suggests that the questionnaire respondents were likely to be less independently mobile than most disabled people. Wheelchair users are over-represented to a very large extent: 61% of survey respondents used a wheelchair compared to between 4% and 9% of all disabled people in Tyne and Wear. Similarly, almost 77% of the 206 respondents could not go out alone, compared to 11% to 19% of all disabled people. Thus, the 206 questionnaire respondents contained higher than average percentages of severely disabled people and of those whose household circumstances were likely to result in reduced mobility capacity. These factors will be borne in mind throughout this Section.

The responses concerning Concessionary Permit holding, Metro use and so on can only be compared with the results of the 1983 Newcastle City survey. These can be summarised as follows:

| | | Questionnaire Survey Respondents | Newcastle City Survey Respondents |
|---|---|---|---|
| i) | Owned Concessionary Travel Permit | 73% | 62% |
| ii) | Used Buses | 36% | 66% |
| iii) | Had been on Metro | 64% | 34% |

Finally, Figure 4.18 shows, in percentage terms, the breakdown of questionnaire respondents into disability groupings, compared with a similar estimated breakdown of all disabled people in Tyne and Wear. A breakdown of questionnaire respondents into specific diseases within each disability grouping is given in Appendix XII to this thesis. It appears that, among questionnaire survey respondents, those with diseases of the central nervous system, visual impairment and injuries and amputations are over-represented while those with diseases of the circulatory system, diseases of the respiratory system and diseases of bones and organs of movement are under-represented.

The results of this survey can be analysed in three stages: firstly, a comparison of the characteristics of respondents who had used Metro with those of respondents who had not; secondly, an examination of the use made of Metro by survey respondents and thirdly, an analysis of the detailed comments made on Metro by respondents. The first two stages will be undertaken in this Section while the third stage will be carried out in Section 3 of Chapter 5. The data was analysed using the statistical package SPSS-X, with particular use being made of the Cross-Tabulation and "Select If" commands to disaggregate data.

Figure 4.19 gives comparisons between the characteristics of respondents who had used Metro and those of respondents who had not.

Most of the differences are as expected. Metro users tended to be more potentially mobile, while there were higher percentages of those with lower mobility among respondents who had not used the system. There were, however, two exceptions to this tendency. Firstly, there was a higher percentage of respondents without a household car (a group with potentially lower mobility) among Metro users than among non-users, probably because those without a car would be forced to rely more on public transport. Secondly, there was a higher percentage of wheelchair users among those who had been on Metro than among those who had not, but there does not seem to be any logical reason for this.

Of those respondents who had used Metro, 111 (or about 86%) had a Concessionary Travel Permit. Although this is a high percentage, it would be reasonable to expect that almost all those who had used Metro would have a Permit. Accordingly, those Metro users who did not have a Permit were sifted out and their reasons for not having a Permit were examined. There were 19 people in this category, but no overall reason emerged. Five people said they were not eligible, including two persons who did not live in Tyne and Wear. A variety of other reasons was given: infrequent use of Metro; availability of other modes of transport; the expiry of a previously-held Permit and (surprisingly) an alleged inability to use Metro. Only one Metro user without a Permit did not know how to apply for one.

Having examined the differences in characteristics of Metro users and non-users, the most appropriate way of examining the use made of Metro by survey respondents is to disaggregate the responses according to disability group, age group and so on. Figure 4.18 gives the numbers and percentages of questionnaire respondents in each disability grouping and, as stated earlier, these show that the questionnaire respondents as a whole are not a representative sample of disabled people in Tyne and Wear. However, disaggregation and examination of the characteristics of each disability grouping, rather than analysis of all the respondents together, will overcome this difficulty. A more complex problem arises in that various characteristics will almost certainly interact. For example, if it were to emerge that the percentage of visually impaired respondents who used Metro was smaller than the overall percentage of respondents who had done so, it might be assumed that for some reason visually impaired people were reluctant to travel by Metro. But, if it then emerged that a smaller than average percentage of elderly respondents used Metro and that most visually impaired respondents were elderly, then low Metro use by visually impaired respondents might be due to their higher than average age rather than any particular lack of provision for visually impaired people on Metro. Consequently, a check was made on the possibility of such problems so that, for example, the age distribution of respondents in each disability grouping was compared with those of respondents in other disability groupings. Moreover, as Figure 4.18 reveals, the numbers of people in some of the disability groupings was quite small so that the results in these cases should be treated with caution.

Figure 4.20 gives a comparison between respondents in different disability groupings, with the aim of comparing the potential mobility of respondents in each grouping. Eight characteristics which imply poor mobility are shown, together with the numbers and percentages of respondents in each disability grouping with these characteristics. The corresponding figures for all respondents are also given. A high percentage of respondents with a particular characteristic will suggest poor potential mobility and the reverse will be true in the case of a low percentage. On this basis, visually impaired respondents and those with diseases of the central nervous system appear overall to have better than average potential mobility, when compared to all respondents. In contrast, respondents with circulatory system diseases have slightly lower than average potential mobility while respondents with diseases of bones and organs of movement and those with injuries and amputations have much lower than average potential mobility.

This estimate of potential mobility can be compared with the Permit holding and public transport use of the various disability groupings as shown in Figure 4.21. The number and percentages of respondents in each disability grouping who held a Concessionary Travel Permit, who used buses and who used Metro are given, again in comparison with all respondents. It might be expected that potential mobility (as shown in Figure 4.20) and overall public transport use and Permit holding would be linked, but this is only partially true. Visually impaired respondents have higher than average potential mobility and their public transport use and Permit holding is also above average. The potential mobility of respondents with diseases of bones and organs of movement is lower than average and their overall public transport use and Permit holding is also lower than average. However, there is less correlation in the case of the other disability groupings.

Figure 4.22 gives the average number of two-way trips per week made by respondents in different disability groupings, as compared to all respondents. Unfortunately, many of the answers to the question on number of outdoor trips were vague, for example, "varies", "depends" and so on. These responses were ignored in the calculations in Figure 4.22. Where respondents gave an approximate answer such as "two or three", the higher number was taken in all cases. The average number of trips per week could not be calculated for three disability groupings due to the low number of respondents in these groupings who answered this question. Of the three groupings shown in the table, visually impaired respondents had the highest average number of trips per week and also had a high level of potential mobility (Figure 4.20). In contrast, respondents with diseases of bones and organs of movement made the lowest average number of trips per week and also had low potential mobility (see also Figure 4.20).

The modes used during an average week by respondents in different disability groupings and by all respondents are given in Figure 4.23. Overall, fewer respondents answered this question than the previous questions on bus and Metro use so that the lower percentages mentioning these modes do not necessarily represent inconsistencies in answers. Moreover, in the earlier question on Metro use, respondents were asked "Have you ever used the Metro?" and the intention was to find out whether respondents had ever been on the system, while question 26 sought to find the modes used regularly. Figure 4.23 shows considerable variation between the different disability groupings but the following points emerged:

i) In percentage terms, fewer respondents in all disability groupings used Metro regularly than had ever used it, and the same applied to use of buses (see Figure 4.21);

ii) Public transport nevertheless remained very important in the trip-making of respondents, both in the different disability groupings and overall;

iii) Higher percentages of visually impaired respondents than of respondents in other groupings used Metro and buses regularly;

iv) No visually impaired respondents said they used "special" transport, but such transport is usually intended for people with physical disabilities, not visual impairment.

Factors other than disability grouping may affect mobility and use of Metro. Respondents can be disaggregated by any of the variables on the questionnaire form, using the "Select If" command in the SPSS-X computer package. The most sensible choices would seem to be age and use of a wheelchair. It should be remembered, as pointed out earlier, that factors will tend to interact.

In order to assess the effect of age, the six age groups used on the questionnaire form were reduced to two, namely 64 and under and 65 and over, respondents in the latter category being termed "elderly". The 206 respondents were also disaggregated according to use of a wheelchair, on the basis of answers to question 11a (see Figure 4.16).

Figure 4.24 gives the characteristics of elderly respondents and of wheelchair-using respondents in an attempt to ascertain the potential mobility of both these groups. The criteria for assessing mobility are the same as in Figure 4.20. Of the 206 respondents, 117 said they were 65 or over. This amounts to 57% of all respondents or 58% of respondents who gave valid responses to the question on age (only four respondents did not reply). 102 respondents said they used a wheelchair, which amounts to 50% of all respondents or 61% of valid responses (39 respondents did not reply to the question on mobility aids). Of the 102 wheelchair users, 53 said they could also walk.

As expected, it seems that the potential mobility of both elderly respondents and of those who used a wheelchair was somewhat lower than average. Figure 4.25 shows the public transport use and Permit holding of both elderly respondents and of wheelchair users, again compared to all respondents. Not surprisingly, overall public transport use of both groups was below average. Among elderly respondents, the use of buses and the ability to use Metro alone were both markedly below the average for all respondents, and only the percentage of people holding a Concessionary Travel Permit was actually above average. Although a lower than average percentage of wheelchair users held a Concessionary Travel Permit, a higher than average percentage were able to open the wide barriers on Metro with their Permits. This would be expected, as wheelchair users are one of the specific categories eligible to receive Permits which open the wide barriers. Indeed, it is surprising that a higher percentage of wheelchair users did not have this facility. Lower than average bus use and lower than average ability to use Metro alone were also to be expected.

The average number of trips per week made by elderly respondents and by wheelchair users were as follows:

| | | |
|---|---|---|
| Elderly respondents | : | 1.9 trips per week |
| Wheelchair users | : | 2.5 trips per week |

Both figures are below the average for all respondents of 3.2 trips per week. Figure 4.26 gives the modes used by elderly respondents and by wheelchair users in a typical week, compared to all respondents. Among elderly respondents, percentage use of cars was below average (only one of the 117 elderly respondents lived in a household with a car) and use of buses was also below average. Use of specialised transport was, however, above average. As regards wheelchair users, use of wheelchairs was naturally above average, while use of buses was considerably below average, again as would be expected.

Having analysed the general characteristics, mobility and Metro use of respondents, disaggregated in various ways, the detailed answers to questions concerning Metro use are given in Chapter 5. It is possible that mobility and Metro use might be affected by factors other than disability. However, since the survey respondents are not a representative sample of disabled people it would be unwise to attempt to present more detailed information than the results are capable of showing. The remaining Sections of this Chapter give details of other surveys and investigations into the use of Metro by disabled people.

## 4.4 Visits to Metro with disabled people and discussions with interested groups

While questionnaire and interview surveys give an opportunity to canvass the opinions of a relatively large number of people, it was felt that much additional information on Metro could be obtained from a number of visits to the system in the company of disabled people and also from discussions with disabled people and interested groups. These visits and discussions are outlined in this Section and the results are analysed in detail in Chapter 5, along with other survey results.

A journey on Metro will give a valuable insight into the real performance of the facilities for disabled people, but care must be taken to ensure that purely subjective and personalised views are avoided. However, the volunteers who visited Metro were either people who had travelled widely and could comment on Metro in comparison with other forms of transport, or were individuals whose professional contact with disabled people enabled them to express opinions which were widely held. The visits were as follows:

i) Two visits by Mr Martin Renouf, one in October, 1983 and a second a year later. Mr Renouf was confined to a wheelchair but could propel himself and was generally very active. As he did not live locally and had not previously been on Metro, the aim was for him to comment upon the system as a first-time user, in comparison with his wide experience of provision for disabled people on public transport and elsewhere, both in the UK and overseas. During the course of his two visits, a total of 31 stations were visited. Some photographs of salient features are presented as Plates at the end of this thesis;

ii) One visit on 16th May, 1984 by Mrs Alison Dudley, who was almost totally blind and had a guide dog. Mrs Dudley was a regular Metro user who commuted daily between Bank Foot and Jesmond. The intention was firstly for her to indicate points she had already encountered and secondly for her to attempt to use part of the system she had not previously been on. Her visit therefore comprised a trip from Jesmond to Monument and then to St James. Although Mrs Dudley was accompanied during her visit, she was only assisted in cases of difficulty, in order to ascertain how she coped on her own;

iii) One visit on 1st April, 1985 with Mr Alan Rowley who was partially-sighted and also had restricted use of his right arm and leg. Like Mrs Dudley, Mr Rowley was a social worker for visually impaired people. He was a frequent user of Metro, being familiar with several parts of the system. The visit comprised an examination of Gateshead and Central stations, and a trip between the two.

In addition to these visits, discussions with various interested groups were also held and three such discussions emerged as being particularly useful. The first was with Mr G Newton, who at the time was Secretary of the Transport Users' Consultative Committee (TUCC) for the North-East and Mr D M Dempsey, Director of the Newcastle upon Tyne Council for the Disabled and also a member of the TUCC. The TUCC for the North-East was one of nine regional TUCCs constituted under the 1962 Transport Act. Their aim is to consider and make recommendations concerning British Rail facilities and services. The TUCC for the North-East also had a similar role for Metro and during the construction of Metro had made numerous suggestions to Tyne and Wear PTE on a number of matters including access for disabled people. In 1985, the Committee's headquarters were moved to York. The Newcastle upon Tyne Council for the Disabled is an umbrella organisation which co-ordinates many local groups for disabled people and represents the interests of disabled people in local affairs, again including access for disabled people to Metro. Many of the representations made by the Council for the Disabled regarding Metro were made through the TUCC while the Council had also helped to publish the report by Manook et al (1978). The recommendations made by the TUCC and the Council for the Disabled which were then under discussion with the PTE are listed and analysed in Chapter 5.

A meeting was also held with the organisers of Access for the Disabled, a group in North Tyneside which used Manpower Services Commission grants to employ young people as escorts for disabled people who would otherwise be unable to go out. Use was made of Metro whenever possible and in some cases, it was hoped that the disabled people concerned would eventually be able to go out alone. The comments from this meeting are recorded in Chapter 5. One of the organisers of Access for the Disabled was himself confined to a wheelchair and was a frequent Metro user. Finally, there was a discussion with Mr Alan Dudley, a social worker for visually impaired people, who was totally blind and used a guide dog. Mr Dudley was the husband of Mrs Alison Dudley, mentioned earlier in this Section. His comments are also recorded in Chapter 5.

The purpose of this Section has been to describe the visits to Metro with disabled people and the discussions held: the detailed results will be presented in Chapter 5, under the sub-headings for each of the different facilities on Metro. In the next Section of this Chapter, the results of various other surveys of the use of Metro by disabled people will be described.

## 4.5 Other studies of the use of Metro by disabled people

This Section contains the results regarding Metro use of other surveys which have already been discussed in this thesis. Section 4 of Chapter 3 gives some of the results of the survey carried out in Newcastle upon Tyne in 1983/84, the report on which was published by the City of Newcastle upon Tyne (1985). Respondents to this survey were asked about their general mobility and also whether or not they had used Metro. Those who had used the system were asked for their opinions, while those who had not were asked if there were any particular reasons. A detailed analysis of the survey methods and of the general results was given in Section 4 of Chapter 3, from which it will be remembered that a one in nine sample of the 106,000 households in the City were sent a questionnaire asking whether any household members were disabled. Detailed interviews were then conducted with a stratified sample of the disabled people thus identified and the results were then factored up to give estimates of the numbers and characteristics of all disabled people in Newcastle.

The second survey to be discussed in this Section (the survey of wheelchair users in North Tyneside) is analysed more fully in Section 6 of Chapter 3. As described in that Section, the survey was undertaken by the Transport Operations Research Group (TORG) of the University of Newcastle upon Tyne in connection with the project to evaluate the prototype wheelchair-accessible CR6 taxi.

Returning to the Newcastle City survey, the estimates of City-wide percentages of disabled people using various forms of public transport are given in Figure 3.20 of Chapter 3. This suggests that about 32% of disabled people used Metro while 63% used buses, but only 12% used Metro frequently (several times a week) compared to 40% who used buses frequently. It was also estimated that 62% of disabled people in Newcastle possessed a Concessionary Travel Permit.

The survey results were particularly useful in providing data on Metro use which could be compared with the results of the survey carried out specifically for this thesis. The effect of age and sex upon Metro use are analysed in Figure 4.27. As mentioned in the footnote, the percentages quoted are percentages of valid responses to all the questions on age, sex and Metro use. Thus it appears that 39% of all respondents said they used Metro, whereas in fact 32% did so. Despite this slight discrepancy, two unmistakable points emerge: firstly, Metro use declined with age and secondly, females used Metro less than males of the same age. 58% of all respondents aged 16-49 used Metro compared with 22% of all respondents aged 75 or over while 44% of all male respondents used Metro compared to 35% of all female respondents. The group with the highest use of Metro in percentage terms was that of males aged 16-49 (55%) while the group with the lowest Metro use was that of females aged 75 or over (15%). These results seem to answer the questions posed in Section 3 of this Chapter regarding the effect of age and sex upon Metro use.

Figure 4.28 gives Metro use according to disability grouping, together with a comparison with the results from the survey undertaken specifically for this thesis (see Section 3 of this Chapter). The two surveys are completely at variance with each other, although higher Metro use in percentage terms was to be expected from the survey carried out for this thesis. However, there is also unexplained variation in the rankings of the disability groupings as regards Metro use. For example, in the Newcastle City survey, the group with the highest percentage use of Metro was that of diseases of bones and organs of movement, while the group with the lowest percentage Metro use was that of visual impairment. In the survey undertaken for this thesis, visually impaired people had the highest percentage Metro use of all disability groupings, while respondents with diseases of bones and organs of movement had the second lowest Metro use. The Newcastle City survey results are probably more accurate in this respect than those of the survey carried out for this thesis, but the latter is not invalidated, as the concept of examining survey respondents in "blocks" according to disability grouping will remain. The Newcastle City survey results will be used to adjust the significance of the findings.

In the survey of 325 wheelchair users in North Tyneside, 107 (or about 34%) of those who gave valid responses said they had used Metro at least once. Of these 107, all but two said they would use Metro again while 18 respondents who had not yet used Metro said they intended to do so in the future. This latter figure is noteworthy since this survey was carried out in early 1983, only a few months after the opening of the St James - Tynemouth section of Metro, which runs through part of the survey area. Consequently, some people might not have had an opportunity to use the system when the survey was conducted. Thus, a total of 123 respondents (about 38%) had used Metro and intended to do so again, or had not been on the system but hoped to use it in the future. Respondents were also asked whether they possessed a Concessionary Travel Permit and, if so, whether this incorporated the facility to open the wide barriers. Of the 300 respondents who answered this question, 99 (about 33%) had a Permit and 64 of these Permit holders could open the wide barriers with their Permits. Thus, one-third of the respondents with Permits could not open the wide barriers, although some of these people might unknowingly have held Permits which incorporated the facility to do so. Nevertheless, it had been expected that almost all the Permit holders in this survey, being wheelchair users, would be able to open the wide barriers at stations. Interestingly, as many as 35 respondents did not have a Permit but used Metro, mainly relying on help from escorts, staff or other passengers in negotiating ticket barriers. At least three respondents did not use their wheelchairs at all when travelling on Metro. Chapter 5 contains detailed analysis of the results of these two surveys as regards the facilities for disabled people on Metro.

Finally in this Chapter, the results of two studies carried out by Newcastle upon Tyne Polytechnic will be discussed. The first of these, by Manook et al (1978) was entitled "Transport Research Survey: A Survey into the Public Transport Needs of Disabled and Elderly Persons in Tyne and Wear" and was produced jointly by Newcastle upon Tyne Polytechnic and the Newcastle upon Tyne Council for the Disabled. This report was published while Metro was still under construction and was really intended as an attempt to secure greater provision for disabled people on the new system than was then envisaged. Reference to the report has already been made in Section 4 of Chapter 2 of this thesis. The report is now really only of historical interest, having been largely superseded. A survey was undertaken for the report into the mobility of disabled people in order to discover how such individuals would cope on Metro, but apart from a visit to the Metro test-track and mock-up, there was little hard evidence to go on. The main point to emerge from the study was that many of the disabled people participating in the survey were very ignorant of even the most basic aspects of the projected Metro system. A copy of the survey questionnaire is given in Appendix VII. The report concluded by regretting that many decisions concerning provision for disabled people on Metro had been taken without the views of such individuals being sought.

The second report produced by the Polytechnic was that by Robinson and Porter (1981). Entitled "'Disabled' People and the Tyne and Wear Metro : A Field Evaluation", this study was undertaken after parts of Metro had been opened, with the Haymarket to Tynemouth section and the Bank Foot branch being operational. The report has already been mentioned in Section 4 of Chapter 2 of this thesis. It was divided into five sections:

Section 1 gave a general analysis of the problems and needs of disabled people on public transport;

Section 2 comprised a historical background to the development of Metro and the facilities for disabled people;

Section 3 contained a general description of the system;

Section 4 gave details of visits to Metro with disabled people undertaken as part of the study;

Section 5 comprised a detailed description, with illustrations, of all stations then opened and of rolling stock and ticketing facilities, plus comments and recommendations.

Section 5 was the largest of all the sections and in fact took up nearly two-thirds of the whole report in its published form. Much of the information in sections 1, 2 and 3, regarding the travel needs of disabled people and background details of Metro, is similar to that given in other Chapters of this present thesis, so a repetitive account of this part of the report will not be given. Robinson and Porter were correct in pointing out that 7% or more of the population is disabled in some way and that this figure is likely to increase, while their description of Metro and its development is essentially accurate.

The aims and methods of the study undertaken by Robinson and Porter were described in section 4 of their report. Local voluntary organisations for disabled people were contacted with the aim of recruiting volunteers to participate in visits to various Metro stations and journeys on the system. Only 23 volunteers were eventually found, of which 14 had used Metro before. In the case of those who had been on Metro, their general experiences of travelling on the system were also noted. The details of each of the 23 volunteers were given and are reproduced in Figure 4.29 while the stations visited and the subjects visiting them are listed in Figure 4.30. All the comments were given in section 5 of the report, in a station-by-station sequence. Reference has already been made in this thesis to the findings and recommendations arising from this study (see Section 4 of Chapter 2). Appendix VIII gives details of the main suggestions made by Robinson and Porter. The results of the individual station visits, and the comments thereon, are given in Chapter 5 of this thesis under the appropriate subject headings, together with the results of the other surveys, reports and investigations described in this Chapter.

Figures - Chapter 4

Figures - Chapter 4 (continued)

Figure 4.1 : Lift Use at Monument Concourse Level, 0800 - 2200 hrs, Tuesday, 22nd November, 1983

| Category of passenger | No. Entering Lift | No. Leaving Lift | Direction not specified | Total |
|---|---|---|---|---|
| Unescorted wheelchair user | - | - | 3 | 3 |
| Escorted wheelchair user | 11 | 3 | 6 | 20 |
| Unescorted visually impaired person | - | - | - | - |
| Escorted visually impaired person | - | 1 | - | 1 |
| Visually impaired person with guide dog | - | 1 | 1 | 2 |
| Other disabled (inc. elderly) | 81 | 27 | 41 | 149 |
| Pram/Pushchair | 55 | 45 | 24 | 124 |
| Unaccompanied children | - | 7 | 8 | 15 |
| Others | 73 | 60 | 59 | 192 |
| Total | 220 | 144 | 142 | 506 |

Source : Tyne and Wear PTE

Figure 4.2 : Lift Use at Monument East-West Platform Level, 0745 - 2145 hrs, Tuesday, 22nd November, 1983

| Category of passenger | No. Entering Lift | No. Leaving Lift | Direction not specified | Total |
|---|---|---|---|---|
| Unescorted wheelchair user | 3 | 1 | - | 4 |
| Escorted wheelchair user | 6 | 5 | 2 | 13 |
| Unescorted visually impaired person | - | 1 | - | 1 |
| Escorted visually impaired person | - | - | - | - |
| Visually impaired person with guide dog | - | - | - | - |
| Other disabled (inc. elderly) | 13 | 17 | 1 | 31 |
| Pram/Pushchair | 33 | 41 | 2 | 76 |
| Unaccompanied children | 24 | 11 | - | 35 |
| Others | 42 | 67 | 4 | 113 |
| Total | 121 | 143 | 9 | 273 |

The East-West Platforms are served by trains running on the St James to Tynemouth section.

Source : Tyne and Wear PTE

Figure 4.3 : Times and locations of surveys of users of lifts, ramps and wide barriers, June, 1984

Monday 25th June

| | | | |
|---|---|---|---|
| 1. | 0930-1230 | Haymarket | 1 Wide Barrier<br>1 Lift |
| 2. | 0930-1230 | Monument | 1 Wide Barrier<br>3 Lifts (1) |
| 3. | 1300-1600 | Gateshead | 1 Wide Barrier<br>1 Lift |
| 4. | 1800-2000 | Central | 1 Wide Barrier<br>2 Lifts |

Tuesday, 26th June

| | | | |
|---|---|---|---|
| 1. | 0930-1230 | Heworth | 1 Wide Barrier<br>2 Lifts |
| 2. | 0930-1230 | South Shields | 2 Wide Barriers<br>1 Lift |
| 3. | 1300-1600 | Byker | 1 Wide Barrier<br>2 Ramps |
| 4. | 1800-2000 | Haymarket | 1 Wide Barrier<br>1 Lift |

Wednesday, 27th June

| | | | |
|---|---|---|---|
| 1. | 0930-1230 | Central | 1 Wide Barrier<br>2 Lifts |
| 2. | 1300-1600 | Chichester | 1 Wide Barrier<br>2 Lifts |

Thursday, 28th June

| | | | |
|---|---|---|---|
| 1. | 0930-1230 | Wallsend (Eastbound) | 1 Wide Barrier<br>1 Ramp |
| 2. | 1300-1600 | Longbenton | 2 Wide Barriers<br>2 Ramps (2) |
| 3. | 1800-1930 | Four Lane Ends | 1 Wide Barrier<br>2 Lifts |

Friday, 29th June

| | | | |
|---|---|---|---|
| 1. | 0930-1230 | Regent Centre | 1 Wide Barrier<br>2 Lifts |

Notes:

(1) To include passengers changing at Monument without leaving the station, counts were made at all three levels of the main lift.

(2) The two ramps at Longbenton are in fact the opposite ends of a ramped footbridge over the tracks.

Figure 4.4 : Lift use during 51 hours of observation, June 1984

| Category of passenger | No. entering lift | No. leaving lift | Total |
|---|---|---|---|
| Wheelchair user electric self-propelled | - | - | - |
| Wheelchair user electric pushed (1) | - | - | - |
| Wheelchair user manual self-propelled | 2 | 3 | 5 |
| Wheelchair user manual pushed (1) | 10 | 12 | 22 |
| Visually impaired + stick only | 1 | 2 | 3 |
| Visually impaired + guide dog only | - | 1 | 1 |
| Visually impaired + escort (1) | 4 | 4 | 8 |
| Ambulant disabled + aid | 18 | 30 | 48 |
| Ambulant disabled + escort (1) | 22 | 13 | 35 |
| Ambulant disabled, no aid or escort (inc. frail elderly) | 68 | 97 | 165 |
| Pram pushchair (2 | 229 | 225 | 454 |
| Encumbered by luggage, shopping etc. | 46 | 50 | 96 |
| Adult, no obvious difficulty | 229 | 253 | 482 |
| Under 16, no obvious difficulty | 44 | 70 | 114 |
| Staff | 25 | 18 | 43 |
| Others | 9 | 6 | 15 |
| Total | 707 | 784 | 1,491 |

(1) Escorts not counted.

(2) Persons accompanying prams/pushchairs not counted.

Figure 4.5 : Wide Barrier use during 44.5 hours of observation, June, 1984

| Category of passenger | No. entering system | No. leaving system | Total |
|---|---|---|---|
| Wheelchair user electric self-propelled | - | - | - |
| Wheelchair user electric pushed (1) | - | - | - |
| Wheelchair user manual self-propelled | 4 | 2 | 6 |
| Wheelchair user manual pushed (1) | 8 | 9 | 17 |
| Visually impaired + stick only | 1 | - | 1 |
| Visually impaired + guide dog only | - | 1 | 1 |
| Visually impaired + escort (1) | 2 | - | 2 |
| Ambulant disabled + aid | 12 | 13 | 25 |
| Ambulant disabled + escort (1) | 2 | 3 | 5 |
| Ambulant disabled, no aid or escort (inc. frail elderly) | 4 | 11 | 15 |
| Pram/pushchair (2) | 263 | 259 | 522 |
| Staff | 16 | 10 | 26 |
| Others | 34 | 12 | 46 |
| Total | 346 | 320 | 666 |

(1) Escorts not counted.

(2) Persons accompanying prams/pushchairs not counted.

Figure 4.6 : Ramp use during 15 hours of observation, June, 1984

| Category of passenger | No. going up | No. going down | Total |
|---|---|---|---|
| Wheelchair user electric self-propelled | - | - | - |
| Wheelchair user electric pushed (1) | - | - | - |
| Wheelchair user manual self-propelled | - | - | - |
| Wheelchair user manual pushed (1) | 4 | - | 4 |
| Visually impaired + stick only | - | - | - |
| Visually impaired + guide dog only | - | - | - |
| Visually impaired + escort (1) | - | - | - |
| Ambulant disabled + aid | 1 | 1 | 2 |
| Ambulant disabled + escort (1) | - | - | - |
| Ambulant disabled, no aid or escort (inc. frail elderly) | 5 | 1 | 6 |
| Pram, pushchair (2) | 41 | 54 | 95 |
| Encumbered by luggage, shopping etc. | 4 | 1 | 5 |
| Adult, no obvious difficulty (3) | 2 | 7 | 9 |
| Under 16, no obvious difficulty (3) | 186 | 243 | 429 |
| Total | 243 | 307 | 550 |

(1) Escorts not counted.

(2) Persons accompanying prams/pushchairs not counted.

(3) "No obvious difficulty" categories not counted for 3 of the 15 ramp hours.

Figure 4.7 : Failures of wide barriers and of lifts observed during surveys, June, 1984

i) Wide barrier failures

| Date | Location | Nature and duration of fault |
|---|---|---|
| 25th June | Haymarket | Jammed open 1126-1230 hrs. (64 min.) |
| 25th June | Monument | Jammed open 0930-1210 hrs. (160 min.) |
| 26th June | Haymarket | Jammed open 1900-2000 hrs. (60 min.) |

Wide barriers jammed open for 284 min. out of 44.5 hours of observation i.e. 10.6% of survey time.

ii) Lift failures

| Date | Location | Nature and duration of fault |
|---|---|---|
| 25th June | Gateshead | Stuck at concourse 1435-1454 hrs. (19 min.) |
| 26th June | Heworth | Lift to South Shields platform inoperative 1145-1230 hrs. (45 min.) |
| 27th June | Chichester | Lift to South Shields platform inoperative 1340-1415 hrs. (35 min.) |

Lifts inoperative for 99 min. out of 51 hours of observation i.e. 3.2% of survey time.

Figure 4.8 : Breakdown of estimates of weekly lift usage according to category of passenger, June, 1984

| Category of passenger | % of total lift usage according to June survey data | Expected total weekly lift usage |
|---|---|---|
| Wheelchair user | 2 | 280 - 420 |
| Visually impaired | 1 | 140 - 210 |
| Ambulant disabled | 17 | 2,380 - 3,570 |
| Pram/Pushchair | 30 | 4,200 - 6,300 |
| Encumbered with luggage, shopping, etc. | 6 | 840 - 1,260 |
| Adult, no obvious disability | 32 | 4,480 - 6,720 |
| Under 16, no obvious disability | 8 | 1,120 - 1,680 |
| Staff | 3 | 420 - 630 |
| Others | 1 | 140 - 210 |
| Total | 100 | 14,000 - 21,000 |

Figure 4.9 : Breakdown of estimates of weekly ramp usage according to category of passenger, June, 1984

| Category of passenger | % of total ramp usage according to June survey data | Expected total weekly ramp usage |
|---|---|---|
| Wheelchair user | 1 | 700 |
| Visually impaired | - | - |
| Ambulant disabled | 1 | 700 |
| Pram/Pushchair | 17 | 11,900 |
| Encumbered with luggage, shopping, etc. | 1 | 700 |
| Adult, no obvious disability | 2 | 1,400 |
| Under 16, no obvious disability | 78 | 54,600 |
| Total | 100 | 70,000 |

Figure 4.10 : Breakdown of estimates of weekly wide barrier usage according to category of passenger, June, 1984

| Category of passenger | % of total wide barrier usage according to June survey data | Expected total weekly wide barrier usage |
|---|---|---|
| Wheelchair user | 3 | 690 |
| Visually impaired | 1 | 230 |
| Ambulant disabled | 7 | 1,610 |
| Pram/Pushchair | 78 | 17,940 |
| Staff | 4 | 920 |
| Others | 7 | 1,610 |
| Total | 100 | 23,000 |

Figure 4.11 : Estimates of the total number of disabled people using lifts, ramps and wide barriers on Metro per week based on June, 1984 survey data

| A<br>Category of disabled passenger | B<br>Estimate based on lift and ramp usage | C<br>Estimate based on wide barrier usage | D<br>"Best" estimate |
|---|---|---|---|
| Wheelchair user | 980 - 1,120 | 690 | 690 - 1,120 |
| Visually impaired | 140 - 210 | 230 | 140 - 230 |
| Ambulant disabled | 3,080 - 4,270 | 1,610 | 3,080 - 4,270 (1) |
| Total | 4,200 - 5,600 | 2,530 | 3,910 - 5,620 |

(1) The "best" estimate of ambulant disabled people using Metro is based only on the lift and ramp usage figures, since individuals in this category are not usually eligible for a wide barrier pass.

Figure 4.12 : Daily numbers and categories of wide barrier users at Gateshead, 0930-1230 hours 10th-16th August, 1985

| Category | Sat 10 Aug | | | Sun 11 Aug | | | Mon 12 Aug | | | Tues 13 Aug | | | Wed 14 Aug | | | Thurs 15 Aug | | | Fri 16 Aug | | | Total | | | Average total daily users |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Entry | Exit | Total | Entry | Exit | Total | Entry | Exit | Total | Entry | Exit | Total | Entry | Exit | Total | Entry | Exit | Total | Entry | Exit | Total | Entry | Exit | Total | |
| Escorted(1) wchr.user | 3 | 2 | 5 | - | 1 | 1 | 1 | - | 1 | - | 2 | 2 | - | - | - | - | - | - | 3 | 2 | 5 | 7 | 7 | 14 | 2.0 |
| Vis.imp. + stick | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Vis.imp. + dog | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 0.286 |
| Vis.imp(1) + escort | - | - | - | 1 | - | 1 | - | - | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 2 | - | 2 | 0.286 |
| Amb.dis. + aid | 2 | 2 | 4 | - | - | - | 1 | 1 | 2 | - | 1 | 1 | - | - | - | 1 | 3 | 4 | 1 | 1 | 2 | 5 | 8 | 13 | 1.857 |
| Amb.dis.(1) + escort | 1 | - | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 | - | 1 | - | - | - | - | - | - | 2 | 1 | 3 | 0.429 |
| Amb.dis. no aid/ escort | - | - | - | - | - | - | - | - | - | 2 | 3 | 5 | 3 | - | 3 | 6 | 2 | 8 | - | 7 | 7 | 11 | 12 | 23 | 3.286 |
| Pram(2) | 25 | 30 | 55 | 6 | 3 | 9 | 37 | 30 | 67 | 33 | 26 | 59 | 33 | 23 | 56 | 24 | 28 | 52 | 24 | 30 | 54 | 182 | 170 | 352 | 50.286 |
| Staff | 1 | - | 1 | - | - | - | 2 | 2 | 4 | 6 | - | 6 | 4 | - | 4 | 4 | - | 4 | 4 | - | 4 | 21 | 2 | 23 | 3.286 |
| Others | 2 | 3 | 5 | - | - | - | 3 | 1 | 4 | 9 | 3 | 12 | 1 | 2 | 3 | 10 | - | 10 | 8 | 2 | 10 | 33 | 11 | 44 | 6.286 |
| Total | 34 | 37 | 71 | 7 | 4 | 11 | 44 | 34 | 78 | 52 | 37 | 89 | 42 | 25 | 67 | 45 | 33 | 78 | 40 | 42 | 82 | 264 | 212 | 476 | 68.0 |

(1) Escorts not counted.

(2) Persons accompanying pram not counted.

*Figure 4.13 : Daily numbers and categories of lift users at Gateshead, 0930-1230 hours 10th-16th August, 1985*

| Category | Sat 10 Aug Entry | Exit | Total | Sun 11 Aug Entry | Exit | Total | Mon 12 Aug Entry | Exit | Total | Tues 13 Aug Entry | Exit | Total | Wed 14 Aug Entry | Exit | Total | Thurs 15 Aug Entry | Exit | Total | Fri 16 Aug Entry | Exit | Total | Total Entry | Exit | Total | Average total daily users |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Escorted(1) wchr.user | 3 | 2 | 5 | - | 1 | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 3 | 2 | 5 | 7 | 5 | 12 | 1.714 |
| Vis.imp. + stick | 1 | 1 | 2 | - | 2 | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - | - | - | 1 | 1 | 1 | 6 | 7 | 1.0 |
| Vis.imp. + dog | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Vis.imp(1) + escort | - | 1 | 1 | 1 | - | 1 | - | - | - | 2 | - | 2 | - | - | - | 1 | 1 | 2 | - | - | - | 4 | 2 | 6 | 0.857 |
| Amb.dis. + aid | 10 | 6 | 16 | 1 | 1 | 2 | 6 | 5 | 11 | 10 | 8 | 18 | 4 | 6 | 10 | 11 | 11 | 22 | 6 | 6 | 12 | 48 | 43 | 91 | 13.0 |
| Amb.dis.(1) + escort | 10 | 2 | 12 | 3 | 1 | 4 | 8 | 6 | 14 | 2 | 4 | 6 | 3 | 3 | 6 | 2 | - | 2 | 3 | 1 | 4 | 31 | 17 | 48 | 6.857 |
| Amb.dis. no aid/ escort | 69 | 68 | 137 | 7 | 4 | 11 | 44 | 68 | 112 | 47 | 61 | 108 | 52 | 76 | 128 | 77 | 84 | 161 | 66 | 68 | 134 | 362 | 429 | 791 | 113.0 |
| Pram(2) | 32 | 29 | 61 | 7 | 6 | 13 | 41 | 41 | 82 | 40 | 31 | 71 | 38 | 22 | 60 | 26 | 33 | 59 | 52 | 42 | 94 | 236 | 204 | 440 | 62.857 |
| Luggage | 21 | 5 | 26 | - | - | - | 2 | 4 | 6 | 2 | 2 | 4 | 13 | 1 | 14 | 8 | 2 | 10 | 8 | 7 | 15 | 54 | 21 | 75 | 10.714 |
| Adults, no obvious diffic'y | 5 | 8 | 13 | 2 | 8 | 10 | 12 | 16 | 28 | 8 | 9 | 17 | 5 | 6 | 11 | 7 | 5 | 12 | 11 | 5 | 16 | 50 | 57 | 107 | 15.286 |
| Under 16, no obvious diffic'y | 5 | 13 | 18 | 8 | 6 | 14 | 16 | 20 | 36 | 9 | 5 | 14 | 6 | 13 | 19 | 10 | 13 | 23 | 13 | 13 | 26 | 67 | 83 | 150 | 21.429 |
| Staff | 2 | 1 | 3 | - | - | - | 2 | - | 2 | - | - | - | 2 | 3 | 5 | 1 | 4 | 5 | 1 | - | 1 | 8 | 8 | 16 | 2.286 |
| Others | 1 | 1 | 2 | - | - | - | 1 | - | 1 | - | 3 | 3 | 1 | 1 | 2 | 1 | - | 1 | 2 | - | 2 | 6 | 5 | 11 | 1.571 |
| Total | 159 | 137 | 296 | 29 | 29 | 58 | 133 | 160 | 293 | 120 | 125 | 245 | 124 | 131 | 255 | 144 | 153 | 297 | 165 | 145 | 310 | 874 | 880 | 1754 | 250.571 |

(1) Escorts not counted. (2) Persons accompanying pram not counted.

Figure 4.14 : Percentages of disabled Metro users in different categories compared to disabled people as a whole

| Category | % of disabled Metro users in category | % of all disabled people in category |
|---|---|---|
| Wheelchair user | 18-20 | 4-9 |
| Visually impaired | 4 | 9 |
| Ambulant disabled | 76-78 | 82-87 |

Figure 4.15 : Details of organisations participating in the questionnaire survey

| Organisation No. | Description | Reply-paid envs. sent? | No.of questionnaires | % response rate |
|---|---|---|---|---|
| 1 | Voluntary worker | Yes | 50 | 0 |
| 2 | Local charity for visually impaired | No | 50 | 6 |
| 3 | Local authority social worker for visually impaired | No | 50 | 8 |
| 4 | Local authority Social Services Dept. | Yes | 100 | 0 |
| 5 | Social club for disabled people | Yes | 8 | 100 |
| 6 | Manpower Services Commission funded scheme to assist disabled people | No | 100 | 70 |
| 7 | Social worker for visually impaired people | Yes | 50 | 0 |
| 8 | Local branch of national charity | Yes | 50 | 84 |
| 9 | Social club for disabled people | No | 60 | 35 |
| 10 | Local branch of national charity | No | 60 | 20 |
| 11 | Local Authority Social Services Dept. | Yes | 50 | 58 |
| 12 | Social club for disabled people | No | 15 | 60 |

Figure 4.16 :

Answers to the questionnaire

survey of disabled people

This Figure shows a copy of the questionnaire form with, where applicable, percentages of valid responses.

The questionnaire form was originally printed on A4-size paper which has been reduced for inclusion in this thesis.

University of Newcastle upon Tyne
Department of Civil Engineering
Division of Transport Engineering

Dear Sir/Madam,

This survey is part of a project to find out whether or not disabled people use the Tyne and Wear Metro. Please try and answer all the questions, whether or not you use the Metro. If you cannot complete the questionnaire yourself, please ask someone to help you. All your answers will be treated in the strictest confidence

1. Name ........................................................

2. Address (or Post Code) .....................................

   ............................................................

   ............................................................

   ............................................................

3. Age*

| | | | |
|---|---|---|---|
| 0 - 16 ☐ | 0.5 | 60 - 64 ☐ | 6.9 |
| 17 - 25 ☐ | 3.5 | 65 - 75 ☐ | 22.8 |
| 26 - 60 ☐ | 31.2 | Over 75 ☐ | 35.1 |

4. Sex* Male ☐ 26.8 Female ☐ 73.2

5. What is your employment status?*

| | | |
|---|---|---|
| Working full time (over 30 hours per week) | ☐ | 8.7 |
| Working part time (under 30 hours per week) | ☐ | 0.5 |
| Seeking work | ☐ | 2.6 |
| Retired/permanently sick | ☐ | 74.4 |
| Housewife | ☐ | 12.8 |
| Full time student | ☐ | 1.0 |

   Other (please specify .......................................)

6. Do you live*

| | | |
|---|---|---|
| On your own in a house/flat | ☐ | 36.9 |
| With at least one other person | ☐ | 47.6 |
| In a sheltered house/flat with a warden | ☐ | 15.0 |
| In a home/hospital etc. | ☐ | 0.5 |

   Other (please specify .......................................)

*tick whichever apply

PLEASE TURN OVER

7. Do you have*

| | | |
|---|---|---|
| A car of your own | ☐ | 8.3 |
| A car in the house | ☐ | 6.7 |
| A car available from someone else whenever you want | ☐ | 8.3 |
| A car available from someone else only in emergencies | ☐ | 15.0 |
| None of these | ☐ | 61.7 |

8. What kind of disability do you suffer from?

.............................................................

.............................................................

.............................................................

9. Are you*

| | | | | | |
|---|---|---|---|---|---|
| Registered disabled | ☐ | 57.0 | Registered blind | ☐ | 20.2 |
| Registered partially sighted | ☐ | 4.5 | None of these | ☐ | 22.7 |

10. Do you receive Mobility Allowance?

| | | |
|---|---|---|
| Yes ☐ | No ☐ | Dont know ☐ |
| 25.8 | 73.0 | 1.2 |

11a. Do you use any of the following when you go out?*

| | | | | | |
|---|---|---|---|---|---|
| Wheelchair | ☐ | 61.1 | Walking frame/Zimmer | ☐ | 10.2 |
| Calipers | ☐ | 4.2 | Guide dog | ☐ | 7.2 |
| Crutches/stick(s) | ☐ | 37.2 | I never go out | ☐ | 6.6 |

b. If you use a wheelchair; are you also able to walk (with crutches, stick etc. if necessary)*

Yes ☐ 32.0 No ☐ 26.6 (N/A 41.4)

12. Do you usually have someone with you when you go out*

Yes ☐ 77.4 No ☐ 22.6

13. What is the maximum distance you think you could travel outside BY YOURSELF (using wheelchair, sticks etc if necessary)

.............................................................

.............................................................

.............................................................

*tick whichever box(s) apply

14a. Do you have a Concessionary Travel Permit for the Buses and Metro?*

Yes ☐ 73.1 No ☐ 26.9

b. If so, can you use the wide barriers at Metro Stations with it?*

Yes ☐ 44.3 No ☐ 15.5 (N/A 27.3) Dont know ☐ 12.9

15. If you do NOT have a Concessionary Travel Permit for the Metro and Buses, why is this?

..........................................................

..........................................................

..........................................................

16. Do you use buses?*

Yes ☐ 36.0 No ☐ 64.0

17. Have you ever used the Metro?*

Yes ☐ 63.7 No ☐ 36.3

18. Will you use the Metro in the future?*

Yes ☐ 68.7 No ☐ 28.2 (Don't know 3.1)

19. If you will not use the Metro in the future, what are the reasons for this?

..........................................................

..........................................................

..........................................................

..........................................................

20. Do you think you could go on the Metro on your own?*

Yes ☐ 20.8 No ☐ 78.7 (Don't know 0.5)

21. If you HAVE used the Metro, which stations have you used?

..........................................................

..........................................................

..........................................................

*tick whichever box(s) apply

PLEASE TURN OVER

22. If you HAVE used the Metro, please state whether you find the following aspects of the system easy, difficult or neither easy nor difficult (tick whichever column applies)

| | Easy | Neither easy nor difficult | Difficult |
|---|---|---|---|
| Using the ticket machines | 32.6 | 28.1 | 39.3 |
| Using the ticket barriers | 49.1 | 25.5 | 25.5 |
| Finding your way around the stations | 31.4 | 31.4 | 37.3 |
| Knowing which is the right train | 40.6 | 23.8 | 35.6 |
| Getting into and out of the lift | 49.5 | 17.8 | 32.7 |
| Using the lift buttons | 46.5 | 20.2 | 33.3 |
| Opening Metro train doors | 38.8 | 17.3 | 43.9 |
| Getting into and out of the Metro trains | 42.6 | 19.4 | 38.0 |
| Getting to the Metro Station | 43.6 | 23.6 | 32.7 |

23. Are there any other comments you would like to make about the Metro?

..............................................................

..............................................................

..............................................................

..............................................................

24. Whether or not you use the Metro, how often on average do you go out of your home each week?

..............................................................

25. Where do you go?

..............................................................

..............................................................

..............................................................

26. What means of transport do you use?

..............................................................

..............................................................

..............................................................

Thank you very much for your help.

Figure 4.17 : Characteristics of questionnaire survey respondents compared with those of all disabled people in Tyne and Wear

| Category | % of qu'aire respondents in category | Estimated % of all disabled in T&W in category |
|---|---|---|
| Aged 0-16 | 0.5 | 4 (aged 0-15) |
| Aged 17-25 | 3.5 | ( |
| Aged 26-60 | 31.2 | (36 (aged 16-59/64) |
| Aged 60-64 | 6.9 | ( |
| Aged 65-75 | 22.8 | 26 (aged 60/65-74) |
| Aged over 75 | 35.1 | 34 (aged 75 and over) |
| Male | 26.8 | 42 to 50 |
| Female | 73.2 | 50 to 58 |
| Living alone | 36.9 | 21 to 32 |
| Without household car | 85.0 | 57 to 76 |
| Wheelchair user | 61.1 | 4 to 9 |
| Unable to go out alone | 77.4 | 11 to 19 |

For estimates of disabled people in Tyne and Wear see Chapter 3, Section 8

Percentage figures refer to percentages of valid responses in all cases.

Figure 4.18 : Breakdown of questionnaire survey respondents by disability compared to estimated breakdown by disability of all disabled people in Tyne and Wear

| Cause of disability | % of qu'aire respondents in category (actual nos. in brackets) | Estimated % of all disabled people in T&W in category |
|---|---|---|
| Diseases of central nervous system | 32 (64) | 19 |
| Diseases of circulatory system | 11 (22) | 26 |
| Diseases of respiratory system | 3 ( 6) | 17 |
| Visually impaired | 27 (54) | 8 |
| Diseases of bones and organs of movement | 31 (62) | 56 |
| Injuries and amputations | 11 (17) | 4 |

Percentage totals exceed 100 in both cases since some respondents stated more than one cause of disability.

Percentage figures refer to percentages of valid responses in all cases.

Figure 4.19 : Characteristics of respondents who had used Metro as compared with those of respondents who had not

| Category | No. (and %) of Metro users in category | No. (and %) of non-users in category |
|---|---|---|
| Aged over 75 | 28 (22) | 42 (57) |
| Male | 40 (31) | 14 (19) |
| Retired or permanently sick | 85 (68) | 58 (85) |
| Living alone | 37 (31) | 32 (49) |
| No household car | 109 (83) | 8 (12) |
| Wheelchair user | 64 (62) | 37 (60) |
| Does not go out alone | 93 (72) | 60 (88) |
| Cannot travel more than 100 yards alone | 59 (53) | 52 (83) |
| Concessionary Travel Permit Holder | 111 (86) | 36 (50) |
| Will use Metro in future | 111 (89) | 21 (31) |
| Could use Metro alone | 38 (30) | 3 ( 5) |

Percentage figures refer to percentages of valid responses in all cases.

Figure 4.20 : Characteristics of respondents in different disability groupings compared to all respondents

| Category | No.(and %) of those with CNS diseases in category | No.(and %) of those with diseases of bones and organs of movement in category | No.(and %) of visually impaired respondents in category | No.(and %) of those with circulatory system diseases in category | No.(and %) of those with injuries & amputations in category | No.(and %) of all respondents in category |
|---|---|---|---|---|---|---|
| Aged over 75 | 12 (19) | 30 (49) | 12 (22) | 8 (36) | 7 (41) | 71 (35) |
| Female | 39 (61) | 57 (92) | 29 (57) | 19 (86) | 10 (56) | 150 (72) |
| Retired or permanently sick | 44 (71) | 49 (85) | 32 (59) | 16 (73) | 13 (81) | 145 (74) |
| Living alone | 15 (26) | 23 (41) | 14 (28) | 10 (46) | 7 (54) | 69 (37) |
| No household car | 42 (67) | 60 (96) | 51 (94) | 22(100) | 16 (94) | 164 (85) |
| Wheelchair user | 47 (83) | 39 (74) | 4 (12) | 7 (32) | 11 (65) | 102 (61) |
| Does not go out alone | 56 (88) | 46 (78) | 34 (64) | 16 (73) | 13 (81) | 154 (77) |
| Cannot travel more than 100 yards alone | 22 (36) | 20 (36) | 2 ( 5) | 9 (41) | 6 (43) | 53 (30) |

Percentage figures refer to percentages of valid responses in all cases.

No results given for respondents with respiratory system diseases due to small number of respondents in grouping.

Figure 4.21 : Public Transport use and Permit holding by respondents in different disability groupings, compared to all respondents

| Category | No.(and %) of those with CNS diseases in category | No.(and %) of those with diseases of bones and organs of movement in category | No.(and %) of visually impaired respondents in category | No.(and %) of those with circulatory system diseases in category | No.(and %) of those with injuries & amputations in category | No.(and %) of all respondents in category |
|---|---|---|---|---|---|---|
| Holds a Concessionary Travel Permit | 38 (62) | 43 (69) | 45 (85) | 21 (96) | 13 (77) | 147 (73) |
| Able to open wide barriers with Permit | 31 (53) | 24 (39) | 22 (44) | 11 (50) | 8 (47) | 86 (44) |
| Used buses | 9 (15) | 15 (25) | 44 (83) | 10 (46) | 5 (31) | 72 (36) |
| Used Metro | 43 (68) | 35 (37) | 42 (78) | 15 (68) | 9 (53) | 130 (64) |
| Intended to use Metro in future | 43 (73) | 37 (62) | 37 (76) | 16 (73) | 14 (88) | 132 (68) |
| Able to use Metro alone | 9 (15) | 11 (18) | 18 (35) | 4 (18) | 3 (19) | 41 (21) |

Percentage figures refer to percentages of valid responses in all cases.

No results given for respondents with respiratory system diseases due to small number of respondents in grouping.

Figure 4.22 : Average number of outdoor trips per week made by respondents in different disability groupings compared to all respondents

| Disability grouping | Average trips per week |
|---|---|
| CNS diseases | 3.5 |
| Diseases of bones and organs of movement | 1.7 |
| Visually impaired | 4.1 |
| All respondents | 3.2 |

Results not given for other disability groupings due to low number of respondents answering this question.

Figure 4.23 : Modes used in an average week by respondents in different disability groupings compared to all respondents

| Mode | No. (and %) of respondents with CNS diseases using mode | No. (and %) of respondents with diseases of bones and organs of movement using mode | No. (and %) of visually impaired respondents using mode | No. (and %) of all respondents using mode |
|---|---|---|---|---|
| Walking | 1 ( 2) | 2 ( 3) | 9 (17) | 11 ( 5) |
| Wheelchair | 15 (23) | 11 ( 8) | 1 ( 2) | 35 (17) |
| Adapted car | 2 ( 3) | - | - | 4 ( 2) |
| Car | 18 (28) | 7 (11) | 6 (11) | 34 (17) |
| Taxi | 6 ( 9) | 4 ( 7) | 3 ( 6) | 14 ( 7) |
| Bus | 6 ( 9) | 10 (16) | 33 (61) | 51 (25) |
| Metro | 8 (13) | 15 (24) | 20 (37) | 48 (23) |
| BR Train | - | - | 2 ( 4) | 2 ( 1) |
| Social Services/ Voluntary Ambulance or minibus, Dial-a-Ride, Community Transport | 18 (28) | 22 (36) | - | 58 (28) |

Percentage figures refer to percentages of valid responses in all cases.

Percentage totals exceed 100 as some respondents gave more than one mode.

Results not given for other disability groupings due to low number of respondents answering this question.

Figure 4.24 : Characteristics of elderly respondents and of wheelchair-using respondents compared to all respondents

| Category | No. (and %) of elderly respondents in category | No. (and %) of wheelchair-using respondents in category | No. (and %) of all respondents in category |
|---|---|---|---|
| Aged over 75 | N/A | 41 (41) | 71 (35) |
| Female | 95 (81) | 78 (78) | 150 (72) |
| Retired or permanently sick | 101 (92) | 84 (86) | 145 (74) |
| Living alone | 52 (47) | 31 (34) | 69 (37) |
| No household car | 116 (99) | 77 (79) | 164 (85) |
| Wheelchair user | 65 (68) | N/A | 102 (61) |
| Does not go out alone | 94 (85) | 96 (95) | 154 (77) |
| Cannot travel more than 100 yards alone | 28 (28) | 59 (63) | 53 (30) |

Percentage figures refer to percentages of valid responses in all cases.

Figure 4.25 : Public transport use and Permit holding of elderly respondents and of wheelchair-using respondents compared to all respondents

| Category | No. (and %) of elderly respondents in category | No. (and %) of wheelchair-using respondents in category | No. (and %) of all respondents in category |
|---|---|---|---|
| Holds a Concessionary Travel Permit | 87 (76) | 69 (70) | 147 (73) |
| Able to open wide barriers with Permit | 42 (38) | 53 (54) | 86 (44) |
| Used buses | 27 (24) | 6 ( 6) | 72 (36) |
| Used Metro | 57 (49) | 64 (63) | 130 (64) |
| Intended to use Metro in future | 67 (60) | 75 (78) | 132 (68) |
| Able to use Metro alone | 10 ( 9) | 8 ( 8) | 41 (21) |

Percentage figures refer to percentages of valid responses in all cases.

Figure 4.26 : Modes used in an average week by elderly respondents and by wheelchair-using respondents compared to all respondents

| Mode | No. (and %) of elderly respondents using mode | No. (and %) of wheelchair-using respondents using mode | No. (and %) of all respondents using mode |
|---|---|---|---|
| Walking | 3 ( 2) | 1 ( 1) | 11 ( 5) |
| Wheelchair | 25 (21) | 33 (32) | 35 (17) |
| Adapted car | - | 4 ( 4) | 4 ( 2) |
| Car | 7 ( 6) | 18 (18) | 34 (17) |
| Taxi | 5 ( 4) | 5 ( 5) | 14 ( 7) |
| Bus | 19 (16) | 2 ( 2) | 51 (25) |
| Metro | 23 (20) | 23 (23) | 48 (23) |
| BR Train | - | - | 2 ( 1) |
| Social Services/ Voluntary Ambulance or minibus, Dial-a-Ride, Community Transport | 44 (38) | 26 (26) | 58 (28) |

Percentage totals exceed 100 since some respondents gave more than one mode.

Percentage figures refer to percentages of valid responses in all cases.

Figure 4.27 : Use of Metro by respondents to the Newcastle City survey, according to age and sex

| Age/sex group | | No. (and %) of age/sex group using Metro |
|---|---|---|
| 16 - 49 | F | 59 (55) |
| 16 - 49 | M | 68 (60) |
| 16 - 49 | ALL | 127 (58) |
| 50 - 59 | F | 24 (39) |
| 50 - 64 | M | 69 (45) |
| 50 - 59/64 | ALL | 93 (43) |
| 60 - 74 | F | 31 (28) |
| 65 - 74 | M | 25 (34) |
| 60/65 - 74 | ALL | 56 (30) |
| 75 and over | F | 13 (15) |
| 75 and over | M | 26 (28) |
| 75 and over | ALL | 39 (22) |
| Total | F | 127 (35) |
| Total | M | 188 (44) |
| Total | | 315 (39) |

Percentage figures are percentages of valid responses i.e. those for whom all data on age, sex and Metro use were available. Thus the figure of 39% of respondents using Metro does not imply that 39% of all respondents used Metro: in fact, 32% of all respondents used Metro.

Figure 4.28 : Use of Metro by respondents to the Newcastle City survey, according to disability, compared with that of questionnaire survey respondents

| Disability grouping | No. (and %) of City survey respondents using Metro | No. (and %) of qu'aire survey respondents using Metro |
|---|---|---|
| Diseases of bones and organs of movement | 175 (42) | 35 (57) |
| Diseases of the circulatory system | 77 (40) | 15 (68) |
| Diseases of the central nervous system | 64 (37) | 43 (68) |
| Injuries and amputations | 11 (33) | 9 (53) |
| Diseases of the respiratory system | 38 (29) | 4 (67) |
| Visual impairment | 11 (24) | 42 (78) |

Column totals exceed the number of Metro users in each survey as some people gave more than one disability.

Percentage figures refer to percentages of valid responses in all cases.

Figure 4.29 : Details of the volunteers participating in the study of Metro by Robinson and Porter (1981)

| Subject No. | Age Range | Sex | Description | Had previously used Metro? |
|---|---|---|---|---|
| 1 | 30-44 | M | Wheelchair user : self-propelled | Yes |
| 2 | 30-44 | M | Blind : uses stick | Yes |
| 3 | 45-64 | F | Blind : guide-dog user | Yes |
| 4 | 15-29 | F | Wheelchair user : self-propelled | Yes |
| 5 | 15-29 | M | Ambulant : unsteady on feet, weak left arm | Yes |
| 6 | 45-64 | F | Electric wheelchair user, also partially-sighted | Yes |
| 7 | 15-29 | M | Partially-sighted : long cane user | Yes |
| 8 | 15-29 | M | Wheelchair user : self-propelled but usually accompanied | Yes |
| 9 | 30-44 | F | Blind : guide-dog user | Yes |
| 10 | 45-64 | F | Wheelchair user : self-propelled | Yes |
| 11 | 15-29 | M | Semi-ambulant : uses wheelchair or sticks | No |
| 12 | 45-64 | M | Wheelchair user : accompanied, escort-propelled | No |
| 13 | 30-44 | M | Partially-sighted : no aid used | No |
| 14 | 45-64 | M | Wheelchair user : accompanied, escort-propelled | Yes |
| 15 | 5-14 | M | Ambulant : right leg amputated | Yes |
| 16 | 15-29 | F | Wheelchair user : self-propelled | No |
| 17 | 15-29 | M | Wheelchair user : self-propelled | No |
| 18 | 15-29 | F | Wheelchair user : self-propelled | No |
| 19 | 15-29 | F | Wheelchair user : self-propelled | Yes |
| 20 | 45-64 | M | Partially sighted : long cane user | No |
| 21 | 45-64 | F | Blind : long cane user | No |
| 22 | 45-64 | M | Partially-sighted : no aid used | Yes |
| 23 | 30-44 | F | Ambulant : right leg amputated, stick user | No |

Figure 4.30 : Stations visited and subjects visiting each station during the study by Robinson and Porter (1981)

| Station | Subjects visiting station (see Figure 4.29) |
|---|---|
| Haymarket | 1, 2, 3, 6, 7, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 22, 23 |
| Jesmond | 6, 9, 16, 17, 18, 19 |
| West Jesmond | 6, 8, 9, 10, 12, 13 |
| Ilford Road | 1, 2, 3, 14, 15 |
| South Gosforth | 7, 8, 11 |
| Longbenton | 8 |
| Four Lane Ends | 1, 2, 3, 4, 5, 7, 8, 11 |
| Benton | 4, 5, 7, 11 |
| Shiremoor | 4, 5 |
| West Monkseaton | 4, 5 |
| Monkseaton | 6, 10, 16, 17 |
| Whitley Bay | 4, 5, 20, 21, 22, 23 |
| Cullercoats | 8 |
| Tynemouth | 6, 12, 13, 20, 21, 22, 23 |
| Regent Centre | 14, 15, 18, 19 |
| Wansbeck Road | 14, 15, 18, 19 |
| Fawdon | 14, 15, 18, 19 |
| Bank Foot | 14, 15 |

# CHAPTER 5 :

# ERGONOMIC ASSESSMENT OF THE FACILITIES ON METRO FOR DISABLED PEOPLE

## 5.1 Introduction

Ergonomics can be defined as the study of the interface between person and machine, with the aim of improving the design of equipment or machinery so as to maximise efficiency and economy of use. The possible applications of ergonomics are almost limitless, but one example might be the re-design of industrial machinery by changing the layout of controls and eliminating awkward movements, so that efficiency and output will be increased. Similarly, ergonomics has been used in the design of vehicle driving cabs to achieve an optimal arrangement of controls and instrumentation in order to reduce driver discomfort and fatigue. Any such exercise will of course involve compromise: not all the controls on a particular machine can be placed in the ideal position but in such a case, the use of ergonomic techniques will enable an assessment to be made of which controls are the most important and frequently used compared to others which might be used only rarely and thus do not need to be within easy reach of the operator.

Any application of ergonomics must take account of the attributes of the likely users of the equipment under study, so that when facilities for disabled people are being considered in this respect, the particular capabilities and requirements of such individuals need to be included. Since the very word disabled implies reduction or loss of ability, an ergonomic evaluation of facilities for disabled people ought therefore to consider the extent to which such facilities take account of the fact that the users will have special needs and problems which make everyday items difficult or impossible to use. In designing such facilities the intention, as with any application of ergonomic techniques, must be to maximise the ease of use of equipment and minimise difficulty and inconvenience. Perhaps the ultimate aim of using ergonomics in designing facilities for disabled people might be the eventual negation of disability, but the extent to which this is immediately practical must remain open to question.

This Chapter will attempt to give an ergonomic assessment of the facilities for disabled people on Metro by focussing on a number of questions, including:

- How do the facilities on Metro compare with the various published specifications and recommendations for such facilities?
- How do the facilities actually perform in the opinion of the users?
- To what extent do the facilities cater for and overcome the disabilities of the users?

These questions will be answered by examining a number of documents containing specifications and suggestions for the design of facilities for disabled people, in conjunction with the results of the surveys of the use of Metro by disabled people which are analysed in Chapter 4. The most important of these documents is that by Goldsmith (1976) entitled "Designing for the Disabled". The third and most recent edition, published in 1976, formed the basis for the design of most of the facilities for disabled people on Metro, so that the facilities which now exist can be assessed according to Goldsmith's specifications. Although a "British Standard Code of Practice for Access for the Disabled to Buildings", incorporating some of Goldsmith's ideas, was produced by the British Standards Institute (1979), neither this Code nor Goldsmith's recommendations have so far been adopted as mandatory requirements. The only legislation in the

UK which is concerned with access for disabled people to buildings is Section 4 of the 1970 Chronically Sick and Disabled Persons' Act (reference has already been made in Chapter 3 to other sections of this Act), part of which reads:

> "Any person undertaking the provision of any buildings or premises to which the public are to be admitted ... shall ... make provision, in so far as it is in the circumstances both reasonable and practicable, for the needs of members of the public visiting the building or premises who are disabled."

The intention behind this legislation is clear: buildings and facilities should henceforth include provision for disabled people and on many occasions Local Authorities have withheld planning permission from buildings which do not incorporate such provision. Indeed, as Chapter 2 shows, this was the case with some Metro stations which were not originally planned to be accessible to disabled people. On the other hand, however, legislation on fire escapes, health and safety at work, licensing laws and a variety of other matters can sometimes work (or be used) against the 1970 Act with the result that disabled people are excluded from new buildings. For example, the planners of a multi-storey building might wish to comply with the 1970 Act and thus incorporate access for disabled people, via a lift, to the upper storeys, in addition to staircases. However, if the Local Authority rejected these plans on the legitimate grounds that lifts alone would not be a satisfactory means of escape for disabled people in an emergency, the planners could conclude that other forms of access to the upper storeys for disabled people were not "reasonable and practicable" and thus no provision would be made for disabled people unable to climb stairs.

No legislation exists regarding access for disabled people to transport systems and although railways have in the past been the subject of legislation, this has generally been concerned with matters such as signalling and brakes. All new railway lines in the UK require to be inspected and passed as safe by the Railway Inspectorate (part of the Department of Transport) and the inspection of a system such as Metro which is accessible to disabled people would include an assessment of the safety implications of the carriage of disabled people. However, the Inspectorate do not lay down any particular regulations on this matter.

A similar situation exists in the United States, although specifications for making buildings and facilities accessible to disabled people have been published by the American National Standards Institute (1980). In the preface to these specifications, readers were reminded that:

> "An American National Standard is intended as a guide... [it] does not in any respect preclude anyone ... from ... not conforming to the standard."

However, guidelines have been used by State and Federal Governments as minimum criteria to be incorporated in projects for which financial assistance is being sought. For example, bus operators who request Federal Government aid towards the purchase of new vehicles have to ensure that such vehicles comply with accessibility criteria laid down by the US Department of Transportation. Chapter 6 of this thesis contains a description of the background to and the results of this situation.

Only one of the sets of specifications discussed in this Chapter, that by Bentzen et al (1981) was specifically intended to deal with public transport and the guidelines given therein are only concerned with the needs of visually impaired people. Goldsmith (1976) does give some general recommendations concerning disabled people and public transport but these are not very specific. However, many of his guidelines can be readily applied to public transport systems although some of the facilities which are peculiar to public transport are not covered. These will accordingly be dealt with separately in Section 3 of this Chapter. Where comments are made in the following Sections on specific Metro stations, these should be read in conjunction with the station plans and notes given in Appendix I.

## 5.2 Description of Sources

The three main sources used in this Chapter will be Goldsmith (1976), the American National Standards Institute (1980) and Bentzen et al (1981). Section 3 of this Chapter contains a discussion of these sources in relation to the findings of the various surveys and investigations described in Chapter 4. The present Section, meanwhile, gives a description of each of these sources.

The most important of these is the standard work by Goldsmith (1976) entitled "Designing for the Disabled". The 1976 edition was the third and most comprehensive version and the design of the facilities for disabled people on Metro was largely based on the guidelines given therein. The book is divided into nine sections, of which section one provides introductory information and comments while section two gives anthropometric data of disabled people, especially wheelchair users. Sections three to eight contain the actual design specifications for access for disabled people to buildings and facilities. These sections together comprise some two-thirds of the book's length. Various facilities are considered, for example, steps, ramps, handrails, doors, lifts and so on, as well as different building types such as public buildings, commercial buildings, transport buildings and institutions. Finally, section nine contains appendices.

According to the Preamble (page 13) Goldsmith is concerned with the interaction between buildings and disabled people, i.e. with ergonomics. His stated aim is "the enhancing of opportunities for people with disabilities", the means to this end being the provision of guidelines for the design of buildings and facilities to enable use by disabled people. Goldsmith avoids becoming entangled in the "politics of disability", but his goal is clearly that disabled people should ideally be granted equal opportunity to participate in society. Much of Goldsmith's work, for example the parts dealing with the design of housing, or of institutions for disabled people, is not relevant to Metro, and in fact only four of the 525 pages deal specifically with transport buildings. However, the specifications for such features as lifts, ramps, staircases and handrails are as applicable to Metro as to any other situation.

A set of guidelines for access for disabled people to buildings has also been published by the British Standards Institute (1979). However, these recommendations comprise only a 12-page document, not all of which can be applied to Metro. In any case, the specifications are much less rigorous and comprehensive than Goldsmith, so that there is no need to discuss them in detail.

The second source which will be analysed in this Chapter is the set of guidelines produced by the American National Standards Institute (1980). Entitled the "American National Standard Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People", these guidelines are usually referred to by their publication reference number, ANSI A117.1-1980. As with Goldsmith, the intention is to provide specifications which will make buildings and facilities accessible to people with a wide range of disabilities. The specifications cover the design of new buildings and facilities as well as the reconstruction and alteration of existing installations. ANSI is intended for adoption by central and local government but, as pointed out in Section 1 of this Chapter, the mere existence of the guidelines does not give them force of law.

Unlike Goldsmith, ANSI does not give recommendations of the way the various facilities should be used in different types of buildings. The recommendations will nevertheless be given in Section 3 of this Chapter, in comparison with Goldsmith and with the results of the various surveys and other investigations.

The third source to be used in this Chapter is the report by Bentzen et al (1981). This is another American publication and is entitled "Techniques for Improving Communication with Visually Impaired Users of Rail Rapid Transit Systems". According to the abstract, this document presents an abbreviated compilation of suggestions "for making rail rapid transit systems accessible to visually impaired travellers". As such, it is the only one of the three sources which concentrates on visually impaired people: both Goldsmith and ANSI are largely concerned with the needs of people whose handicaps arise from mobility problems.

Bentzen and her colleagues set out firstly to identify problems experienced by visually impaired users of rail rapid transit systems and secondly to suggest ways of overcoming such problems. The identification of problems was achieved by surveys of visually impaired people and their social workers in various US cities with rapid transit systems, by trips on systems with visually impaired people and also by a literature search. In all, 60 separate problems were identified and possible solutions were suggested, mainly by discussions with transport planners, architects and consultants as well as with visually impaired people. Some aspects of the systems studied do not apply to the Tyne and Wear Metro, but items which are appropriate are discussed in the next Section.

## 5.3 The Ergonomic Performance of the Facilities for Disabled People

This Section will combine the detailed comments on Metro emerging from the surveys and other investigations described in Chapter 4 with the specifications given in the three sources mentioned in Section 2 of this Chapter. The ergonomic performance of the various facilities for disabled people can then be assessed. Each of the facilities will be described below, under individual sub-headings for each item. References to individual Metro stations should be read in conjunction with the station plans in Appendix I. Some of the data from the surveys and investigations described in Chapter 4 is more suitably presented in tabular form, this being carried out in Figures 5.1 to 5.27, of which Figures 5.1 to 5.20 contain data from the survey carried out specifically for this thesis. These data are in most cases given according to respondents' disability grouping or other category. Figures 5.21 to 5.27 give data from the other surveys and investigations described in Chapter 4.

1) General facilities on Metro

Only Goldsmith (1976) includes in his specifications a general discussion of the extent to which public transport buildings should include provision for disabled people. Section 7, sub-section 77, paragraphs 7720 to 7723 (pp 401-402) deal with underground railways and rapid transit systems. The main points can be summarised as follows:

i) It is not essential to make provision for wheelchair users, but consideration should be given to the needs of ambulant disabled people;

ii) All entrances to station buildings should be accessible to ambulant disabled people;

iii) Where turnstile ticket barriers are installed, an alternative access gate should also be provided;

iv) All areas of stations should be accessible to ambulant disabled people;

v) Any stairs should have handrails on both sides;

vi) Escalators, where provided, should preferably travel direct from street level to platform level;

vii) An alternative to escalators should be provided;

viii) Lifts, where provided, should preferably travel direct from street level to platform level, but where this is not possible the need to use stairs should be minimised;

ix) Lavatories, where provided, should include one WC compartment for each sex which is usable by ambulant disabled people.

The specifications for making approaches to stations and passenger areas within stations accessible to disabled people will be discussed later in this Section under the appropriate sub-headings. It is very significant that Goldsmith does not consider it necessary to make provision for wheelchair users. He argues that while the development of new rapid transit systems does provide opportunities to include provision for ambulant disabled people, the additional cost of provision for wheelchair users would be very high in relation to the fairly small number of such individuals who would probably use such systems. Although he acknowledges the efforts made to cater for wheelchair users on BART in San Francisco and the Washington Metro, he claims that funds for such provision could have been more effectively used elsewhere - by which he presumably means on providing some kind of specialised transport.

Apart from this one area of divergence (in which Goldsmiths's specifications are in fact exceeded) the facilities on Metro meet the recommendations. There are no toilets on Metro stations, but Goldsmith's guidelines only state that if toilets are provided they should be accessible to disabled people. The results of the surveys and other investigations into the use of Metro by disabled people do not yield many general comments on Metro except that reports such as Robinson and Porter (1981) support the provision of facilities for disabled people and would probably not agree with Goldsmith's recommendations that the needs of wheelchair users need not be considered.

2) Footways and Kerbs

Goldsmith gives his specifications for footways and kerbs in section 3, sub-section 30, paragraphs 3000 to 3027 (pp 163-164) as follows:

i) All footpaths should be of fixed and firm materials such as bitumen macadam, tarmacadam or asphalt. Gravel surfaces should be avoided;

ii) Where pre-cast slabs or blocks are used, these must be laid flush to avoid hazardous uneven edges;

iii) Kerbs should be ramped at all crossing places, to facilitate use by self-propelled wheelchair users.

Neither the American National Standards Institute (1980) nor Bentzen et al (1981) make any recommendations regarding footways or kerbs.

The results of some of the surveys described in Chapter 4 show that while the design of footways and kerbs at or near Metro stations generally fulfils these requirements, this is not invariably the case. It should be remembered that, while kerbs and pavements in the vicinity of Metro stations may be outside the station curtilage and thus be the responsibility of the Local Authority rather than Tyne and Wear PTE, such features will nevertheless be associated with Metro in the minds of users. Visits to several Metro stations by Mr Martin Renouf highlighted a number of minor points concerning footpaths and ramps (see Chapter 4, Section 4). When he visited Wansbeck Road station, he found that some of the paving slabs at the bottom of one of the ramps had become uneven, leaving a protruding edge. Obviously, this was a Local Authority matter and rectification should be simple. Plate 1 (at the end of this thesis) shows that on the most direct route between the car park and station at Four Lane Ends, a kerb had been built without a ramped section. This was simply due to an oversight and rectification would hopefully be straightforward. The question of dropped kerbs also arose during the discussion with Messrs Newton and Dempsey (see again Chapter 4, Section 4). A list of recommendations for improvements to the facilities on Metro had been made jointly by the Transport Users' Consultative Committee for the North-East and by the Newcastle upon Tyne Council for the Disabled: the list is reproduced in Figure 5.21. Items (1) and (2) comprised recommendations that more dropped kerbs be provided and that uneven walkways be repaired.

Robinson and Porter (1981) also drew attention to various deficiencies in respect of kerbs and walkways. At South Gosforth, the only means of changing platforms without using the station footbridge (which has steps only) was via a circuitous route which involved leaving the station and using the adjacent pavements and road overbridge. Pavements on this route were uneven and there was a lack of dropped kerbs. Attention was drawn to the lack of a dropped kerb at Four Lane Ends on the route between the car park and the station buildings, which Mr Renouf also criticised (see above). Robinson and Porter also stated that footpaths and pavements in the vicinity of Benton station were uneven and in poor condition. Some dropped kerbs had been installed on the route between the station and the nearby Percy Hedley Centre for Spastics but there were not enough of these and many of those which had been provided were uneven or too steep. Similarly, criticism was also made of the poor condition of footpaths and kerbs in the vicinity of the following stations: Whitley Bay; Cullercoats; Wansbeck Road; Fawdon and Bank Foot. Robinson and Porter therefore made the general recommendations (as given in Appendix VIII) that improvements in this respect *should be effected*. None of the other studies into the use of Metro revealed any significant level of comment regarding footways and kerbs.

3) Staircases and steps

In sub-section 31 of section 3 (pp 165-167) Goldsmith's recommendations regarding staircases and steps are:

i) In any building where provision is made for disabled people, lifts and/or ramps should be provided in addition to steps or stairs, but as some ambulant disabled people may prefer stairs to ramps or lifts, it is not desirable that only ramps or lifts should be provided;

ii) Single steps are hazardous since they can be easily overlooked, and should thus be avoided;

iii) Open risers to steps should be avoided;

iv) Colour contrasts of treads and risers can be helpful for visually impaired people;

v) In any flight of stairs, all the risers should be of equal height and all the treads (goings) should be of equal depth;

vi) Tread surfaces should be non-slip and wooden treads should be fitted with non-slip nosings;

vii) Nosings should not protrude sharply;

viii) On external steps, the risers should not exceed 165mm (6.5 in.) and the treads should not be less than 280mm (11 in.);

ix) On internal steps, the risers should not exceed 200mm (7.8 in.) and the treads should be at least 210mm (8.3 in.);

x) Goldsmith's specifications for access for disabled people to rapid transit systems (see above) include the recommendation that all staircases should have handrails on both sides.

The specifications for staircases in ANSI are given in section 4.9 (pp 26-29) and are as follows:

i) Within each flight of stairs, treads should be of equal depth and risers should be of uniform height;

ii) Treads should be at least 280mm (11 in.) deep;

iii) Nosings should not protrude;

iv) Step edges should have tactile markings;

v) Handrails should be provided on both sides of all staircases. They should remain unbroken throughout the staircase and should continue for at least 305mm (12 in.) beyond the top and bottom of all staircases.

ANSI is therefore less comprehensive and also less strict than Goldsmith in this respect (and in fact in most others). The suggestions made by Bentzen et al (1981) are:

i) Stairs and/or lifts (elevators) should always be provided as an alternative to escalators;

ii) Handrails on staircases should project beyond the top and bottom of all staircases;

iii) Step edges should have contrastingly coloured markings;

iv) Where a staircase consists of two or more flights of stairs separated by short landings, handrails should be unbroken throughout and should not be discontinued at landings.

Again, these guidelines echo parts of Goldsmith's specifications, but are more obviously made with visually impaired people in mind.

The steps and staircases at Metro stations generally fulfil many of the above specifications, although there is some variation and deficiencies are apparent in a number of cases. At purpose-built Metro stations, riser heights and tread depths are generally standardised as follows:

Internal staircases

Treads 280mm (11 in.) and risers 170mm (6.7 in.)

External staircases

Treads 300mm (12 in.) and risers 160mm (6.3 in.)

These dimensions are well within the recommendations. However, even at new stations, handrails are not always provided on both sides of staircases and many external staircases at new suburban stations lack the contrastingly coloured and textured step edges provided on internal staircases at sub-surface stations. In addition, at former British Rail stations, step dimensions do not always meet the recommendations and steps on some of these older staircases have also become worn and uneven (see Appendix I for detailed station plans and notes).

It should be remembered that, at sub-surface stations, passengers will not normally need to use stairs, since lifts and escalators are also available. Similarly, ramps are also always provided at suburban stations as an alternative to steps. However, in a number of instances, especially at former British Rail stations, ambulant disabled people may often prefer steps which offer a more direct means of changing levels than ramps, which can involve a more circuitous route.

Some comments regarding staircases and steps did emerge from the surveys and investigations described in Chapter 4. When Mr Alan Rowley visited Metro, he pointed out a problem with the handrails on one of the staircases at Central Station, leading down from street level to the concourse. This staircase consists of three flights of stairs separated by short landings, where the handrails are interrupted. Mr Rowley commented that this could cause confusion to a visually impaired person. Goldsmith, ANSI and Bentzen et al all state that handrails should continue uninterrupted throughout the length of all staircases. Mr Rowley also thought that all step edges should have contrasting markings, and that the markings which were provided on some staircases were insufficiently distinct.

Mr Alan Dudley's remarks concerning staircases and steps largely centred upon the lack of staircases between concourse and platform levels at Monument. Other sub-surface stations have escalators, lifts and staircases between platform and concourse levels but Monument has escalators and lifts only. This could cause difficulty in the event of lift failure since most guide dogs will usually refuse to go on escalators.

Only one respondent to the survey carried out for this thesis remarked upon the steps (see Figure 5.12). This criticism came from a visually impaired person and concerned the lack of colour contrasts on step edges.

The criticisms made by Robinson and Porter focussed upon step markings, protruding nosings and uneven steps. They pointed out that many staircases, both at new and former BR stations, do not have contrastingly coloured and textured step edges. South Gosforth, Longbenton, Benton and Whitley Bay were cited as examples of deficiencies in this respect. In addition, the step risers at Benton had been left open. At some older stations, footbridge steps often had protruding nosings and in a number of cases had become worn and uneven. These problems were noticed by volunteers at Whitley Bay and Cullercoats. The list of recommendations made by the Transport Users' Consultative Committee and the Newcastle upon Tyne Council for the Disabled (see Figure 5.21) included suggestions that staircase handrails should continue uninterrupted throughout the length of all staircases (thus echoing Mr Alan Rowley's comment) and also that tactile markings should be provided at the top and bottom of staircases.

Although Metro staircases do not comply with the recommendation that handrails should continue for a short distance beyond the top and bottom of each staircase, none of the above comments referred to this.

4) Ramps

Goldsmith's recommendations for the design of fixed ramps are given in section 3, sub-section 32, paragraphs 3200 to 3259 (pp 168-172):

i) The preferred maximum gradient for all ramps is 1 in 12, but not all disabled people, particularly wheelchair users, will be able to manage a ramp of even this gradient;

ii) General purpose ramps should preferably be at least 1500mm (4 ft. 11 in.) wide;

iii) Rest platforms should be provided, but to avoid confusing visually impaired persons these should preferably only be where ramps turn;

iv) Handrails should be provided where ramp gradients are steeper than 1 in 10;

v) Handrails and/or kerbs should be provided where there is a drop to the side of the ramp;

vi) Ramps should have non-slip surfaces such as coarse bitumen, tarmacadam or asphalt. If concrete is used, it should have a non-slip surface even when wet;

vii) External ramps liable to be affected by frost or snow may be protected by built-in heating with thermostat controls.

The specifications laid down in ANSI are given in section 4.8 (pp 24-26):

i) The least possible gradient shall be used for any ramp;

ii) In new construction, ramps should be no steeper than 1 in 12 and the maximum rise should be 760mm (2 ft. 6 in.);

iii) All ramps should be at least 915mm (3 ft.) wide;

iv) Level landings should be provided at the top and bottom of all ramps, and at any point where the ramp changes direction;

v) Outdoor ramps should be designed so that water does not accumulate on surfaces;

vi) Ramps of over 1830mm (6 ft.) in length should have handrails (see later for handrail specifications).

In some respects, these specifications are less stringent than those given by Goldsmith, while in other areas they demand higher standards. ANSI suggests a minimum gradient of 1 in 12 and also states that ramps should have the shallowest possible gradient, while Goldsmith states that 1 in 12 is the overall best, although some wheelchair users may be unable to manage even this. On the other hand, Goldsmith does allow for the possibility of ramps which are steeper than 1 in 10. Neither Goldsmith nor ANSI insist on handrails for all ramps, but their criteria for handrail provision are different. Goldsmith suggests handrails on ramps with gradients steeper than 1 in 10 or where there is a drop to the side of a ramp, while ANSI insists on handrails on ramps longer than 1830mm (6 ft.).

As with steps and staircases, the ramps at Metro stations generally comply with Goldsmith's specifications (and thus also with ANSI) but there are instances of ramp provision falling short of the guidelines. Although all ramps at purpose-built Metro stations, and new ramps added to older stations, generally have a gradient of 1 in 12 or shallower, older ramps at former BR stations were not designed with wheelchair access in mind and are often considerably steeper. All new and many older ramps are at least as wide as Goldsmith's suggested 1500mm (4 ft. 11 in.). Due to the very nature of Metro station layouts, it would not have been possible to comply with the recommendations in ANSI that the maximum rise of any ramp should be 760mm (2 ft. 6 in.). Many suburban Metro stations are on embankments and the required rise is greatly in excess of this figure, but patronage is too low to justify the expense of providing lifts. Other areas of difficulty are highlighted in the following comments.

The survey carried out for this thesis revealed a number of criticisms of ramp provision. Comments made by respondents in various disability groupings (Figures 5.10 and 5.11) include a variety of remarks to the effect that ramps are too steep. Walkergate station ramp is specifically mentioned in Figure 5.10 and again in Figure 5.11 while the comment in the latter also refers to Monkseaton. Both these stations have ramps inherited from British Rail which do not comply with Goldsmith: ramp gradients at Walkergate vary from 1 in 6 to 1 in 10, while the ramps at Monkseaton are 1 in 7 throughout. Figure 5.10 also contains a complaint that ramps at older stations generally are too steep. By comparing the comments on ramps made by all respondents (Figure 5.15) with the comments on ramps made by both elderly respondents (Figure 5.13) and by wheelchair-using respondents (Figure 5.14) it emerged that all 12 of the respondents who complained about ramps were wheelchair users and seven of these were elderly. This is to be expected, given the difficulty of self-propelling or pushing a wheelchair up a ramp, as compared to walking up it. Figure 5.15 reveals other comments concerning ramps, including remarks that some were in poor condition.

Mr Martin Renouf's two visits to Metro (see Chapter 4, Section 4) yielded a considerable amount of information on ramp provision. Plates 2 to 16 illustrate the variety of ramp design and gradient: in general, Mr Renouf thought that new ramps built to Goldsmith's specified gradient of 1 in 12 or less were more satisfactory than the steeper ramps inherited from British Rail. Particular points which emerged regarding purpose-built ramps were as follows:

i) Plate 2 shows Mr Renouf ascending the ramped footbridge at West Jesmond, which has a gradient of 1 in 12 throughout, and was "acceptable". Moreover, the asphalt surfacing gave a good grip for wheelchair tyres even in the wet conditions when the photograph was taken;

ii) Longbenton (Plates 3 and 4) has a spiral footbridge, also with a gradient of 1 in 12 which presented no problems;

iii) The ramp up to the westbound platform (for trains to

Monument) at Bede station, is on the right of the general view of the south of the station in Plate 5. This again has a gradient of 1 in 12. Although Mr Renouf found this also to be satisfactory, there were no signs to indicate the location of the ramp, an omission which might have caused confusion to other users. The ramp to the eastbound platform (for trains to South Shields) is shown in Plate 6 and was also acceptable;

iv) In contrast, the ramps at Wallsend were less satisfactory. Plate 7 shows the ramp up to the eastbound platform (for trains to Tynemouth) and although this only has a gradient of 1 in 13, it was described as "significant" by Mr Renouf. The ramp up to the west-bound platform (for trains to Monument) is shown in Plate 8: the gradient of this ramp changes about halfway up from 1 in 16 to 1 in 13 and while Mr Renouf found the lower part to be "easy", he thought the upper section was noticeably steeper. The major problem at Wallsend however was not the gradients of the ramps but their length;

v) At Chillingham Road station, there is a long *ramp up from* each of the two platforms to Chillingham Road itself, the illustration in Plate 9 being of the ramp from the eastbound platform (for trains to Tynemouth). Mr Renouf found the ramp gradient of 1 in 13 acceptable but as at Wallsend the ramp itself was rather long and tiring due to the overall layout of the station;

vi) Plate 10 illustrates the ramped footpath from Manors station. Although the gradient was again 1 in 12, the hairpin-bend was situated on an incline and therefore difficult to negotiate;

vii) An overall view of Jarrow station is given in Plate 11. The ramp from the eastbound platform (for trains to South Shields), which is on the right of the picture, has a gradient of 1 in 12 and was again "acceptable". However, the only ramp access to and from the westbound platform (for trains to Monument) involved a circuitous route via the adjacent road overbridge from which this photograph was taken;

viii) At Percy Main, the ramp from the eastbound platform (for trains to Tynemouth) was of acceptable gradient (1 in 12 again) but was poorly signed. Someone unfamiliar with the station could have tried to use the adjacent rough, unsurfaced path thinking this was the only ramped access. The ramp leading to the westbound platform (for trains to Monument) was again acceptable at 1 in 12 and Mr Renouf thought that its four stages with hairpin-bends were probably a less daunting prospect than a long one-piece ramp such as those at Wallsend (Plates 7 and 8) even if the gradients were the same;

ix) The ramp at Four Lane Ends station from the car park to the concourse also has a gradient of 1 in 12 and although Mr Renouf found this acceptable, he did not like the ramp surface. This was composed of brick tiles, which had become slippery due to heavy rain, and an asphalt surface such as that at West Jesmond (see above) would have been preferable;

x) The ramps from each of the platforms at Wansbeck Road station were both "acceptable", being similar to those at Bede (Plates 5 and 6) although the gradients differed. The ramp to the platform for Monument had a gradient of 1 in 15 while that leading to the platform for Bank Foot had a gradient of 1 in 11. However, at the foot of the latter ramp one of the paving slabs had become uneven, leaving a protruding edge, although this was really the responsibility of the Local Authority;

xi) Various other stations with new ramps were visited and found to be satisfactory, including Heworth, Gateshead Stadium, Ilford Road and Byker. Two stations at ground level (Bank Foot and Fawdon) were also visited and the minimal ramps were quite satisfactory.

In contrast, Plates 12 to 15 show ramps at various ex-BR stations where ramp access had not been improved with the conversion to Metro. Mr Renouf's evaluations of these were as follows:

i) Plate 12 shows the lower part of the ramp from Tyne Dock station down to Boldon Lane, which is adjacent. This section of ramp is part of the old station structures and has a gradient of 1 in 8. It was therefore less acceptable than the rest of the ramp which was purpose-built for Metro and has a gradient of 1 in 12;

ii) At North Shields, the two ramps down to the platforms (one of which is shown in Plate 13) were part of the BR station buildings and thus were not intended for wheelchair access. Mr Renouf considered the gradient of 1 in 11 to be "passable", though more difficult than the purpose-built ramps. However, standard handrails had been fitted to both sides;

iii) Similarly, at Felling station, the ramp from the platforms shown in Plate 14 was also rather steep, according to Mr Renouf. The gradient was 1 in 11 and the ramp surface was also in poor condition as shown in the photograph. In addition, the only access from the footbridge at the top of the ramp to Mulberry Street (on the north side of the station) was via a short flight of steps. Pavement access to Sunderland Road (to the south of the station) was steep and uneven. Handrails and a roof had however been added to the ramp from the platforms;

iv) Plate 15 shows Mr Renouf at the top of the ramped footpath up to the eastbound platform (for trains to Whitley Bay) at Benton. The path had a gradient of 1 in 8 at this point while the surface was very uneven. Mr Renouf had a great deal of difficulty ascending this ramp;

v) At West Monkseaton station, Mr Renouf thought the ramps were again very steep. Gradients here are 1 in 7 throughout;

vi) South Gosforth station, at the junction of the Bank Foot branch and the northern part of the North Tyne loop, has no direct access between platforms for wheelchair users. Mr Renouf therefore had to leave the station and follow a circuitous route via the adjacent road overbridge. He found that this involved quite steep gradients.

Figure 5.21 shows that "improvements to ramps at older stations" was one of the recommendations made by the Transport Users' Consultative Committee and the Newcastle upon Tyne Council for the Disabled. During the discussion with the organisers of Access for the Disabled (see Chapter 4, Section 4) in North Shields, the group's organisers were also critical of ramp gradients, especially at the older stations in their catchment area.

The comments from respondents to the Newcastle City survey (see Chapter 4, Section 5) who had used Metro are given in Figure 5.22. Four comments focussed upon ramps, either with respect to steepness of gradients or the number of ramps provided. Figure 5.25 gives general comments on Metro made by respondents to the survey of wheelchair users in North Tyneside (see again Chapter 4, Section 5) while Figure 5.26 shows details of stations used by respondents and specific comments thereon. Six respondents made some form of unfavourable general comment on ramps (Figure 5.25) and several ramps at specific stations were also criticised (Figure 5.26). The latter table shows that comments were directed about equally at new stations or old stations with new ramps (Wallsend, Whitley Bay, Four Lane Ends, Longbenton, Shiremoor and Percy Main) and at stations with ramps inherited from BR (North Shields, Monkseaton and West Monkseaton).

Robinson and Porter cite a number of criticisms of ramp provision made by volunteers involved in their study, as follows:

i) Although the ramped footbridge at Longbenton has "standard" gradients of 1 in 12 throughout, the ramps are spiral rather than straight and one volunteer found the continuous bends difficult to negotiate;

ii) Wheelchair users who visited Benton criticised the steepness of the ramps (up to 1 in 8). Both they and ambulant disabled visitors complained about the uneven and pot-holed surface of parts of these ramped footpaths;

iii) One of the unaccompanied wheelchair users who visited Shiremoor said that the ramp from the eastbound platform (for Whitley Bay) was "tiring", despite the gradient of 1 in 12;

iv) All the wheelchair users who visited West Monkseaton said that the ramp gradients were too steep at 1 in 7 throughout. The non-standard handrails were also unsatisfactory;

v) Three out of the four wheelchair users who visited Monkseaton said they could not ascend the 1 in 7 ramps unassisted (the fourth had an electric wheelchair and did not report any difficulty). The smooth tarmac surface of the ramps gave a poor grip for wheelchair tyres;

vi) One of the wheelchair users who visited Cullercoats station said the ramped footpath with a gradient of 1 in 9 up from the platform for Whitley Bay to St George's Avenue was too steep to attempt alone, and in winter was not cleared of snow and ice;

vii) Three wheelchair users visited Wansbeck Road station, of which only one reported any difficulty with the ramps, which have gradients of 1 in 11 and 1 in 15.

In general, it would seem that many of the adverse comments regarding ramp provision could have been avoided had Goldsmith's specifications been followed. However, it must be remembered that reconstruction of ramps at former BR stations to give shallower gradients would often be a very difficult and expensive process, sometimes requiring almost the entire station to be rebuilt. In cases such as Benton where the station site is extremely constricted by surrounding roads and buildings, expansion of the station area would also pose significant problems. It should be added that difficulties were by no means confined to older and steeper ramps. Some new ramps with "standard" gradients were deficient in other respects, such as surfacing while it does seem that some wheelchair users or their escorts would be unable to manage even a 1 in 12 gradient. The length as well as the gradient of ramps appears also to be an important factor, but where significant changes of level are involved, for example at Wallsend, little can be done to alleviate the problem without installing lifts. This would again be a very expensive solution, given the probable low usage of such facilities at suburban stations. Some improvements to ramp provision could however be made at lower cost, such as the fitting of standard handrails where these are not at present provided, or the resurfacing of uneven ramps. Regular clearance of snow and ice would again not be very costly, although installation of heating would be more expensive.

5) Handrails

In section 3, sub-section 33, paragraphs 3300 to 3337 (pp 173-175), Goldsmith's specifications for handrail provision are:

i) Handrails should be provided on each side of all staircases and any ramp with a gradient steeper than 1 in 10;

ii) Handrails should always be continuous and not broken at landings;

iii) They should be easy to grip and those which are circular in section should have a diameter of between 45mm (1.8 in.) and 50mm (2 in.);

iv) On staircases, handrails should be at least 850mm (2 ft. 9.5 in.) above the stair treads;

v) Where possible, handrails should extend horizontally at least 300mm (12 in.) beyond the top and bottom of any staircase;

vi) Plastic or plastic-covered rails are preferable to metal or metal-covered rails since the former afford a better grip when hands are cold or wet.

Apart from the recommendations concerning the fitting of handrails to staircases and ramps (see above) neither ANSI nor Benzten et al have any specifications regarding handrails. Some of Goldsmith's guidelines, for example concerning the fitting of handrails to ramps with gradients steeper than 1 in 10 and the need for handrails to be continuous, are discussed above under the sub-headings dealing with staircases and with ramps.

New handrails on staircases and ramps at Metro stations are of standard dimensions, being circular in profile, 50mm to 60mm (2 in. to 2.4 in.) in diameter and located 900mm to 1100mm (2 ft. 11 in. to 3 ft. 7 in.) above the level of the ramp or staircase to which they are fixed. All handrails are either polished or painted metal. Goldsmith's specifications are thus largely followed, except for his recommendation that handrails should be plastic or plastic-covered.

The survey carried out for this thesis (Chapter 4, Section 3) yielded only one remark about handrail provision, as given in Figure 5.15, namely a complaint that there were no handrails at stations. It is not clear how this erroneous remark originated.

Handrails are of relevance not only as support for people with mobility problems, but also as a means of guidance for visually impaired people. The comments made by Mr Alan Rowley and others concerning handrails on staircases and ramps are noted under those sub-headings above. As pointed out in the station plans and notes in Appendix I, some but by no means all of the former BR stations have had new handrails fitted on staircases and ramps.

6) Lifts

Goldsmith's specifications for lift provision are given in section 4, sub-section 45. Paragraphs 45000 to 45326 (pp 218-225) deal with public lifts, as opposed to lifts in private dwellings. His recommendations are:

i) Lifts must be provided if it is anticipated that wheelchair users will need to change levels;

ii) There should be sufficient space in lift lobby areas to allow wheelchair users, people with prams, pushchairs, luggage and so on to enter without having to manoeuvre;

iii) If handrails are provided inside lifts, these should be at about 1000mm (3 ft. 3 in.) above floor level;

iv) Minimum lift dimensions will vary according to amount of traffic, whether or not wheelchairs are to be accommodated and, if so, whether these will be standard or large wheelchairs;

v) A 12-person general purpose passenger lift is the minimum necessary if disabled people using large wheelchairs are to be accommodated. Such a lift will require to be not less than 1400mm (4 ft. 7 in.) deep by 1600mm (5 ft. 3 in.) wide, with a doorway at least 800mm (2 ft. 8 in.) wide;

vi) Lift controls should be easy to manipulate and heat-sensitive touch-light control buttons are preferred to buttons which have to be pushed. Buttons should be raised rather than recessed;

vii) To assist visually impaired people, embossed digits should be provided either on control buttons or on the panel next to the buttons. Embossed *digits should not be in Braille since not all* visually impaired people can read Braille;

viii) Control buttons should be arranged in a vertical rather than a horizontal sequence. To facilitate use by unaccompanied wheelchair users, controls should not be more than 1300mm (4 ft. 4 in.) above floor level;

ix) Each lift landing should have a "lift coming" indicator incorporating an audible signal;

x) An indication of the floor level should be clearly visible on each floor when the lift door opens;

xi) An indication inside the lift should also signal the direction of travel and the floor level reached.

ANSI also gives guidelines for lift provision, in section 4.10 (pp 29-32). Unlike Goldsmith, these do not insist on lift provision but state that if lifts are provided they should be as follows:

i) Call buttons outside lifts should be centred at 1065mm (3 ft. 6 in.) from the floor and should have a visual signal to indicate that the buttons had been pressed;

ii) A visible and audible signal should indicate whether the lift is travelling upwards or downwards when it arrives;

iii) All lift door entrances should have raised or engraved symbols to indicate the floor level;

iv) Doors should re-open automatically if an obstruction is encountered;

v) Lifts should be large enough to allow wheelchairs to enter, manoeuvre and exit, and should be at least 1730mm (5 ft. 8 in.) by 1370mm (4 ft. 6 in.);

vi) All control buttons inside lifts should have visual and tactile indications. The latter may be embossed or engraved and may consist of letters and numbers or symbols, but if symbols are used they should be to a standard system, for example, star for up, circle for down. Control buttons inside lifts should be no higher than 1370mm (4 ft. 6 in.);

vii) When the lift stops at or passes a floor level, there should be audible and visual indications of the floor which has been reached or passed;

viii) Emergency communication facilities, if provided, should have buttons and control equipment no more than 1370mm (4 ft. 6 in.) above floor level. Control buttons and instructions should incorporate visual and tactile markings, using either engraved or embossed lettering.

Once again, Goldsmith's guidelines are, in general, stricter and more wide-ranging. The recommended lift dimensions are almost identical: ANSI requires a lift at least 1730mm (5 ft. 8 in.) by 1370mm (4 ft. 6 in.) while Goldsmith suggests minima of 1600mm (5 ft. 3 in.)

by 1400mm (4 ft. 7 in.). Goldsmith does not permit buttons inside lifts to be higher than 1300mm (4 ft. 4 in.) while ANSI suggests a maximum of 1370mm (4 ft. 6 in.). However, one point on which the lift specifications in ANSI exceed Goldsmith is that the former recommends that all lift door entrances should have tactile (raised or engraved) indications of the floor level, in order to assist visually impaired people. Goldsmith only recommends a visual indication. No guidelines concerning lift provision were given by Benzten et al.

All lifts on Metro are of standard dimensions and layout. They are 1100mm (3 ft. 7 in.) wide by 1500mm (5 ft. 11 in.) deep with a door 1000mm (3 ft. 3 in.) wide and are thus somewhat smaller than Goldsmith recommends, although the doors are wider than his specification. A handrail is provided at a height of 1000mm (3 ft. 3 in.) and control buttons are arranged in vertical sequence at a height ranging from 900mm (2 ft. 11 in.) to 1100mm (3 ft. 7 in.). Although these arrangements comply with Goldsmith, the buttons are not touch-light as he recommends, but require to be pushed. In addition, the wording on and adjacent to the buttons is engraved rather than embossed.

Lifts are the principal means of changing levels at major stations for most disabled people and are also used by many other groups such as people with prams or pushchairs and staff (the surveys analysed in Section 2 of Chapter 4 show that non-disabled lift users outnumber disabled users). Consequently, most of the surveys of disabled people discussed in Chapter 4 resulted in numerous comments on lift provision. The survey of disabled people carried out especially for this thesis (see Chapter 4, Section 3) included a question on whether respondents found a given number of different aspects of Metro to be easy, difficult or neither easy nor difficult (see Figure 4.16 of Chapter 4). Lift buttons and lift entry/exit were among the aspects listed.

Figure 5.5 gives numbers and percentages of respondents, in various groupings, finding lift entry/exit easy or difficult. Only a minority of respondents in each grouping seem to have found difficulty in this respect, although the minorities are quite large in some cases, for example 43% of respondents with diseases of the central nervous system. Results for disability groupings other than those given in the table are not shown because of the small numbers of respondents. When wheelchair users were separated out and their answers to this question analysed, only a minority reported any difficulty.

The results for lift buttons are given in Figure 5.6 and again no group emerged as having particular difficulty in this respect. However, a number of criticisms concerning lifts emerged from the question which invited general comments on Metro. Figures 5.10, 5.11, 5.12, 5.13 and 5.14 give the comments made by respondents in various groupings while Figure 5.15 lists all the comments made by all respondents. If remarks that there should be more lifts at particular stations or that lifts are crowded are taken to infer that existing lifts are too small, criticism of size emerges as the most frequently-mentioned complaint about lifts. Out of the 24 comments about lifts shown in Figure 5.15, 13 were in this vein and a comparison with Figure 5.14 shows that 10 out of these 13 complainants were wheelchair users. This is not surprising since a person in a wheelchair takes up more floor space than a standing person, so a lift will fill up much more quickly if a wheelchair user is among the passengers. Complaints about lifts did not feature very prominently among the comments made by visually impaired people, unlike all the other groupings, and the smaller number of remarks made by such individuals tended to concentrate on problems with the layout of lift buttons.

As a wheelchair user, Mr Martin Renouf devoted a considerable part of his two visits to Metro to assessing the lifts. Although all lifts are of standard dimensions, he used lifts at a number of different stations. Plate 16 shows the entrance to one of the lifts at St James station, there being one lift to each of the two platforms. The roof-hung sign indicating the lift will be noted. Although the lifts at St James are well located and easy to find, Plate 17 shows the location of the lift at the North-South platform level of Monument station. Due to overall design constraints, the lift entrance in this case is rather out of the way, although again the signs incorporating the international disability symbol will be noted. The various stages involved in using the lift are shown in Plates 18, 19 and 20. Once again, these photographs were taken at St James station but all lifts on Metro are the same size (see above). The Plates show that Mr Renouf had no difficulty in operating either the lift call buttons or the control buttons inside the lift. He used a total of 15 lifts at various stations and all were found to be in working order although this was only a small spot-check and can hardly be described as a statistically valid survey of lift reliability. No other problems were encountered in using the lifts, except that when Monument station was visited, a small queue had formed for the lift at concourse level. In practical terms, the lifts will accommodate two pushchairs and one escort each or a pushchair and a wheelchair plus one escort each, but probably not two wheelchairs plus escorts. The lift capacity at Monument was inadequate due to the large number of people at this station. Mr Renouf also used the lifts at Manors, Haymarket, Jesmond, Regent Centre, Central Station, Heworth, Chichester and South Shields and found these to be satisfactory in all respects.

Mrs Alison Dudley's visit to Metro is described in Section 4 of Chapter 4. Her comments on lifts mainly centred upon problems of orientation. At Jesmond station, she was able to find the lift without difficulty since she used the station regularly and had learnt the layout by heart. However, at Monument she had to ask the way to the lift since she had used this station only very occasionally in the past. She travelled by lift up to the concourse and then to street level: once back at concourse level, she again had to ask for help in locating the lift and in establishing which of the two platform levels she required for travel to St James station. Once inside the lift, Mrs Dudley pointed out that since the main lift at Monument serves three different levels (the two platform levels plus the concourse) difficulties arise which do not occur with other lifts on the system which only serve two levels. At all the other stations with lifts, a visually impaired person need only enter the lift and press all the available buttons until the lift moves: once the lift stops and the doors open, the desired level will then have been reached. In contrast, at Monument, Mrs Dudley was unable to work out which button to press. She said that she was unable to make out the engraved lettering on the buttons, in common with most visually impaired people. Moreover, although there are illuminated signs inside lifts to indicate which level has been reached, there are no corresponding tactile or audible indications, so that Mrs Dudley was again reliant upon advice and assistance. At St James, Mrs Dudley was again unable to locate the lift without guidance. Once Mrs Dudley had located the lift entrance in each case, she was able to enter and leave the lifts without difficulty, but as noted earlier, the main problem arose from a lack of tactile and audible information on lift buttons and so on.

Figure 5.21 shows that the Transport Users' Consultative Committee and the Newcastle upon Tyne Council for the Disabled had also voiced comments regarding lifts. Point (5) on their list concerned an examination of lift button design to assess possible improvements, while Point (11) raised the question of improved signing of the lift at Central Station. This latter issue also emerged from the comments made by respondents to the Newcastle City survey (Figure 5.22). One person evidently thought that there were no lifts at Central Station, which may be a reflection on poor signing.

Respondents to the survey of wheelchair users in North Tyneside were also asked a number of questions concerning Metro. Figure 5.24 gives details of difficulties encountered: in fact, nearly three-quarters of respondents said they had no experience of lift use on Metro at all. However, of those who had used lifts all but a very few reported no difficulty with lift use in general or with lift buttons. Figure 5.25 nevertheless shows that four respondents made general comments to the effect that the lifts were too small. No remarks about lifts emerged from the specific comments on stations as given in Figure 5.26, but not very many of the respondents detailed in this table appear to have used stations with lifts.

Robinson and Porter made the following points with regard to lift use:

i) At Haymarket, four of the wheelchair users who visited the station complained of having to queue for the lift because of children playing in it or cleaners using it to move heavy equipment.

Two of the unescorted wheelchair users said that the control buttons were poorly located and awkward to reach;

ii) None of the eight visually impaired volunteers at Haymarket, even those who used the station regularly, were able to find their way through the concourse to the lift without difficulty or assistance. Once inside the lift, the control buttons were said to be difficult to locate and only one visually impaired volunteer could actually make out the engraved lettering;

iii) Some of the ambulant disabled volunteers preferred to use the lift at Haymarket rather than the escalators or stairs, but complained about the *lack of seats adjacent to the lift entrance.*

Similar remarks also emerged from visits to other stations with lifts (Jesmond, Four Lane Ends and Regent Centre) except that there were no complaints of queues as these stations are less heavily-used than Haymarket.

Once again, it does seem that if Goldsmith's specifications had been followed more closely, some of the above criticisms might have been avoided, particularly with reference to lift size, lettering on control buttons and improved indications of floor levels and direction of travel. However, not all of the difficulties encountered by visually impaired people would have been overcome by recourse to Goldsmith. The specifications contained in ANSI seem to provide some solutions in this respect, but it would not be reasonable to expect the facilities on Metro to have taken account of this document.

In addition to the above comments, some problems also emerged with aspects of lift operation not covered by any of the sets of specifications. Figures 5.15 and 5.25 show that a number of criticisms arose of lift maintenance and cleaning. Several respondents said that lifts were unreliable while others commented that they were dirty, which probably relates to graffiti and other vandalism. During the counts of the numbers and categories of people using lifts at Metro stations in June, 1984 (see Chapter 4, Section 2), a note was made of the duration and nature of any lift failures. Figure 4.7 shows that, taken together, the lifts surveyed were operative for 97% of survey time. Reliability thus seems to be good, although no great statistical validity can be attached to these figures since they covered only a short space of time. As noted in Section 4 of Chapter 4, no instances of lift failure were encountered during either of the visits to Metro with Mr Renouf although again this was more a spot-check than an exhaustive survey. The fact remains that some disabled Metro users perceive the lifts to be unreliable and/or dirty. A distorted view of lift reliability may be due to the fact that, for someone unable to use stairs or escalators, an occasional instance of lift failure will cause great inconvenience and thus be remembered in contrast to the greater number of occasions when the lifts were used without difficulty.

7) Escalators

Goldsmith's specifications for escalators are very brief, being given in section 4, sub-section 45, paragraphs 45420 and 45421 (p 225). His only recommendation is that escalators should never be relied upon as the only means of changing levels: in order to meet the requirements of wheelchair users, many ambulant disabled people and some visually impaired people, lifts should also be provided. He also suggests in paragraphs 45410 to 45413 (p 225) that passenger conveyors (also known as travelators, moving pavements or movators) may be more suitable for ambulant disabled people than escalators, but only where gradients would not be steeper than 1 in 4.7. There would not have been enough room within the confines of sub-surface Metro stations for a passenger conveyor of this gradient, so escalators were installed, with lifts and (in most cases) stairs as alternatives.

The specifications laid down by Benzten et al echo the recommendation that escalators are not the most suitable means of changing level for visually impaired people, so lifts and/or stairs should also be provided. ANSI does not contain any guidelines regarding escalator provision.

Goldsmith's expectations that escalators are not of great significance for disabled people seems to be borne out by the fact that very few comments were made regarding escalators in any of the various surveys and investigations. Figure 5.15 shows only one comment regarding escalators while Figure 5.21 contains one recommendation about the marking of escalator steps. Comments by respondents to the Newcastle City survey did, however, include remarks that four respondents disliked escalators (Figure 5.22). In addition, three respondents who had not used Metro gave a dislike of escalators as their reason for not going on the system (Figure 5.23). However, it is possible that these individuals had been on Metro at some time and these remarks were really reasons for not wanting to use it again. The solution to problems with escalators may be to give lifts greater and more carefully-targetted publicity. At present, some ambulant disabled people may not be aware of the existence of lifts at sub-surface stations, or may see the international disability symbol on lift signs and assume that the lifts are intended only for wheelchair users.

8) <u>Car Parking</u>

Goldsmith gives specifications for a variety of "external spaces" in section 5, sub-section 58, and paragraphs 5800 to 5807 (pp 322-323) deal with car parking. Car parks or car parking spaces are provided at several Metro stations so it is worth considering the layout of these. Goldsmith's specifications are:

i) Car parks used by the general public should include provision for disabled drivers and cars carrying disabled passengers;

ii) In Britain, the standard car parking space is about 2400mm (7 ft. 10 in.) wide. Where parking bays for disabled car users are located at the end of a row or otherwise adjacent to a space, they need not be any wider than this;

iii) Where parking bays for disabled car users have other parking bays on either side, more room should be provided, especially for wheelchair users. In this case, spaces should be at least 3200mm (10 ft. 6 in.) wide and preferably 3600mm (11 ft. 10 in.) wide;

iv) Car parking spaces for disabled car users should be suitably signposted with the international symbol for disabled people and this symbol may also be painted on the ground in each space, to deter non-disabled people from using these spaces.

Neither ANSI nor Bentzen et al contain any guidelines regarding car parks. Designated parking spaces for disabled car users have always been provided at the large car parks at Four Lane Ends, Regent Centre and Heworth. At first, however, the dimensions were the same as those for all car parking spaces, i.e. 2600mm (8 ft. 6 in.) wide by 4900mm (16 ft. 1 in.) deep. Designated spaces for disabled car users have now been widened to 3000mm (9 ft. 1 in.), some 200mm (8 in.) short of Goldsmith's recommended minimum.

Relatively few comments emerged concerning car parking, which perhaps reflects low levels of car ownership and use among disabled Metro users. When Mr Martin Renouf visited Four Lane Ends station, which has a car park with nine spaces designated for disabled people, it was found that all of these spaces were occupied by cars with no indication of being used by disabled people (Plate 21). However, at the start of one of his visits, Mr Renouf travelled by car to Bank Foot and was able to park his car in the small station car park, transfer to his wheelchair, propel himself to the platform and board a train without difficulty and without requiring assistance. The suggestions for improvement to the facilities on Metro (Figure 5.21) included a request for wider car parking bays for disabled car users and this has now been carried out as described above.

Robinson and Porter also drew attention to the problem of parking spaces for disabled car users being taken up by other motorists. In addition, they suggested that the smaller car parks at Shiremoor, Fawdon and Bank Foot should also include some reserved spaces for disabled car users.

Neither Goldsmith nor ANSI include any detailed material specifically intended for light rail transport systems (although Goldsmith does include some general guidelines, as quoted earlier in this Section). The guidelines given by Bentzen et al do refer exclusively to systems such as Metro, but they deal only with the needs of visually impaired people. Since the remaining aspects of the facilities for disabled people are peculiar to light rail transport systems, the only guidelines available are those given by Bentzen et al. Consequently, the needs of visually impaired people will be considered in the light of these recommendations, while points concerning people with other disabilities will be dealt with in relation to the comments arising from the various surveys and investigations described in Chapter 4.

9) Information displays, signs, maps, diagrams and other location aids

In order for partially-sighted people to perceive and understand the necessary information concerning their journey, the following are recommended by Bentzen et al:

i) Signs should be well-lit, either internally or externally, and lighting should be positioned so as to eliminate glare and not to cast shadows;

ii) Lettering on signs should contrast with backgrounds. Light-coloured lettering on a dark background gives greatest legibility;

iii) Glossy-backed enamel signs tend to reflect glare and signs with a matt surface are preferable;

iv) Signs with large print should be used throughout;

v) Large print maps should be installed, preferably with internal illumination and using contrasting colours. Large type pocket maps for individual use can also be used;

vi) Vandalised or defaced signs should be replaced.

For people with very little or no residual sight, audible and tactile cues were suggested as follows:

i) A pathway consisting of tiles or other flooring material incorporating contrastingly textured markings would provide continuous guidance. Coloured as well as tactile markings would help partially-sighted people;

ii) An ideal solution to problems of orientation would be some form of "auditory pathway" using a series of electronically-activated messages emanating from speakers broadcasting recorded or synthesized speech and located at strategic points throughout stations. Speakers would be triggered by electronic activating devices issued to visually impaired people. However, Bentzen and her colleagues admitted that no such system existed at the time their guidelines were written so that the "auditory pathway" was purely hypothetical.

At present, most of the information provided on Metro for passengers consists of visual data. Information signs at stations mostly employ large type, but there are instances,at the sub-surface stations, where several signs are suspended from the ceiling above the platforms. From some angles, one sign will obstruct the view of another and in addition the general station lighting can cause glare. The majority of signs have black lettering on a yellow background (these being the "house" colours of Metro) which gives a good contrast although Bentzen and her colleagues preferred dark backgrounds with light-coloured lettering. Certain signs, however, are in different colours: for example, all the "EXIT" signs have white letters on a green background while all the "ENTRY" signs have white lettering on a red background. Neither of these are good colour contrasts and although any partially-sighted person who knew the system would simply follow red signs into the system and green signs to find the way out, this presumes a prior knowledge of the colour code which a first-time passenger would probably not have. Maps are provided at Metro stations and although the colours used are quite bright and varied, with different colours for each of the four Metro lines, the print is not especially large. Moreover, the maps at several suburban stations have been vandalised. Pocket timetables and maps are available but there are no large print versions. At smaller suburban stations, many of the signs are in smaller print than at the larger stations.

Figure 5.3 shows the answers, given by respondents to the survey undertaken for this thesis, to the question on whether orientation within stations was easy or difficult. The only grouping in which a majority of respondents reported difficulty was that of visual impairment, where 61% of respondents said they had problems. Figure 5.12 indicates that two visually impaired respondents commented on the need for greater uniformity of station layouts.

When Mrs Alison Dudley visited Metro (see Chapter 4, Section 4) her main complaint of the system as a whole concerned the lack of information available to visually impaired people. On her trip from Jesmond to Monument and then to St James and back to Monument, she encountered a number of problems due to a lack of suitable information.

She was able to find her way round Jesmond station quite easily as she used the station daily. In contrast, once at Monument she became disoriented. The intention was for her to go from the platform for trains from Jesmond up to street level and then find her way to the platform for St James, but on arrival at Monument, a (false) fire alarm was sounding and a public address announcement warned passengers not to use the lifts. Since Mrs Dudley could not use the escalators, she had to ask several passengers whether there were any stairs to concourse level, but no-one was able to help her (there are in fact no stairs at Monument between either of the platform levels and the concourse). After a few minutes, the fire alarm stopped and it was announced that the lifts could be used again, but by this time Mrs Dudley had become so disoriented that she had to ask another passenger the way to the lift. Street level was then reached without further difficulty and Mrs Dudley then re-entered the station in order to travel to St James. She could not establish which of the two platform levels was required and after having been guided to the correct level (via the lift) she again had to ask which platform was the correct one for St James. Her comments regarding the lifts are recorded earlier in this Section under the appropriate sub-heading. Once at St James, Mrs Dudley needed assistance in locating the lift to travel up to concourse level. She then had to ask for help yet again, in finding the correct platform for the next train back to Monument as the illuminated "next train" display gives a visual indication only (see Plate 23).

Mrs Dudley was of the opinion that many visually impaired people either had tried to use Metro and had given up or were afraid to try the system at all, the reason being in both cases the lack of audible and tactile information to prevent them becoming lost or stranded. She said that tactile, audible and (for partially-sighted people) visual information needed to be improved as follows:

i) Tactile information should be simple, clear and standardised. Complex instructions in Braille or Moon (a system similar to Braille which uses raised lines and shapes instead of dots) would be unnecessary since only a minority of visually impaired people can read either. Mrs Dudley suggested that a strip of contrastingly coloured and textured material could be laid to guide visually impaired people through stations, an idea which echoed Bentzen's recommendations. She said that the ideal material would be a line of tiles but a strip of textured paint would be cheaper and just as effective providing it was of a highly contrasting colour and was resistant to wear and fading;

ii) The only sources of audible information on Metro, i.e.

the "speak and receive" information devices, were not, in Mrs Dudley's opinion, very useful since visually impaired people could not locate them easily and in any case they were not provided at all stations. She conceded that visually impaired people could always ask other passengers for help, but said that many such individuals were embarrassed about asking for help and in any case other passengers were not always available or willing to assist. Comments about spoken announcements on trains and at stations are made later in this Section, under the sub-heading "Identifying Trains";

iii) Having worked with partially-sighted as well as blind people, Mrs Dudley commented that there was also a need for better visual information, especially by providing contrasting markings on corners, step edges and similar features and also by improving the quality of signs.

Mr Alan Rowley also made a number of comments concerning information, signs and so on during his visit. He pointed out that the main problem regarding station layouts was the lack of overall standardisation. Although some items, such as the ticket machines, were of uniform dimensions and colours throughout the system, their location differed from one station to another. There were no audible or tactile cues by which visually impaired people could orientate themselves in a relatively large station concourse and find objects including ticket machines and barriers which were often distributed around the periphery of the concourse area. At Gateshead station, Mr Rowley drew attention to a large illuminated advertisement stand situated in the concourse. He commented that many partially-sighted people would probably find it easier to read large notices, such as the very detailed bus timetable information display at this station, if they were similarly mounted on illuminated panels.

Figure 5.21 reveals that the Transport Users' Consultative Committee and the Newcastle upon Tyne Council for the Disabled made a number of suggestions concerning the provision of information. Point (11), which dealt with signing of the lift at Central Station, has already been noted under the sub-heading of "Lifts". There were also requests as follows:

i) Marking out of walkways in stations (Point 14);

ii) Discussions on location of direction and information indicators (Point 16);

iii) Emergency communication facilities at stations (Point 19);

iv) Publication of a fully descriptive booklet listing the facilities on Metro (Point 25).

The discussion with Mr Alan Dudley also concentrated on questions of information and orientation. Mr Dudley pointed out that the major obstacle preventing visually impaired people from using Metro was uncertainty. Such individuals tended to be worried and reluctant about coping with any new or unfamiliar situation and lacked the confidence to try Metro even though the system offered greater mobility opportunities. More reassurance before and during journeys was required, especially with regard to orientation.

Robinson and Porter also raised several of the points already discussed above in their analysis of visits to Metro with disabled people:

i) Several of the partially-sighted volunteers who visited new sub-surface stations complained that the white enamel wall panels tended to merge together so that it was difficult to discern the exact location of walls and corners. Contrasting marking of corners would alleviate this problem;

ii) Many partially-sighted people also said that the roof-hung signs were too high and would be more easily read if placed on walls at shoulder height;

iii) Wheelchair-using volunteers said that the "speak and receive" information devices were too high for them. Several of the volunteers who used the smaller suburban stations complained about the lack of such equipment at these stations.

10) <u>Ticket Machines and Ticket Barriers</u>

In his general recommendations for underground railways and rapid transit systems (see above) Goldsmith does specify that, if turnstile ticket barriers are the main means of entry/exit for such a system, wider gate-type barriers should also be provided for disabled passengers. However, he does not add any further specifications.

The recommendations given by Bentzen and her co-authors regarding ticketing arrangements cover both staffed and unstaffed systems, so only those suggestions relevant to unstaffed stations will be given, as follows:

i) Coin slots on ticket vending machines should have a border with contrastingly coloured and textured (preferably raised) markings;

ii) Location of entry barriers should be standardised;

iii) An "auditory pathway" (see above) or a route with visual and tactile markings should be provided to the ticket barriers;

iv) Visually impaired people should be allowed to use the wide ticket barriers provided for wheelchair users.

All ticket machines on Metro are of a standard design and will issue single, transfer and multiple-journey (carnet) tickets and give change. Plate 22 shows the layout of fare buttons, coin slot and so on. This photograph was taken when Mr Martin Renouf visited Metro and shows that the coin slot and some control buttons were out of maximum reach from his wheelchair (he was however provided with a Travel Pass and Wide Barrier Key on both his visits so did not require to purchase tickets). Most disabled people resident within the Tyne and Wear area would be eligible for a Concessionary Travel Permit and would not need to purchase tickets from machines (see Appendix II for a description of the scheme and conditions of issue). However, disabled people from outside the locality are not eligible, neither are partially-sighted people with more than a certain level of residual sight.

Appendix II also gives the conditions of issue of Wide Barrier Keys. Wheelchair users and visually impaired people are normally able to have a facility for opening the wide barriers encoded onto their Concessionary Travel Permits: other groups of people eligible for a Wide Barrier Key (but not for concessionary travel) are as given in the Appendix.

Plates 23 to 25 illustrate the wide barrier and the steps involved in using it. The station illustrated is St James: the layout of ticket barriers varies from station to station as shown in the plans in Appendix I. All the wide barriers are the same width throughout the system, i.e. 800mm (2 ft. 7 in.) as opposed to 520mm (1 ft. 8 in.) for the turnstile barriers. At some suburban stations, exit for all passengers is effected via a door rather than by barriers (although turnstile and wide barriers are still provided for entry). These doors are all 870mm (2 ft. 10 in.) wide. The survey of wheelchairs and their users in North Tyneside by Hall and Silcock (1985) included a study of wheelchair dimensions. Out of 364 wheelchairs recorded, the widest was 730mm (2 ft. 5 in.) although the mean width was 608mm (2 ft 0 in.) and only 5% of wheelchairs were wider than 680mm (2 ft. 3 in.). This suggests that all wheelchair users would be able to fit through the wide barriers and exit doors, although clearances may be restricted for the very widest wheelchairs.

Figures 5.1 and 5.2 show the numbers and percentages of respondents to the survey carried out for this thesis finding ticket machines and ticket barriers easy, difficult or neither easy nor difficult. A high level of response to the question on ticket machines (Figure 5.1) was not expected since most respondents should have been eligible for a Concessionary Travel Permit. However, several respondents did reply and the only disability grouping in which a majority of respondents who answered the question said they had difficulty was that of visual impairment. This may be because, as stated earlier, some partially-sighted people are not eligible for a Permit and will therefore require to purchase tickets. With regard to ticket barriers, only a minority of respondents in each grouping had difficulty (Figure 5.2).

General comments on Metro made by respondents in different groupings and by all respondents are given in Figures 5.10 to 5.15. Criticisms of ticket machines (Figures 5.10, 5.12 and 5.15) and of ticket barriers (Figures 5.12, 5.13, 5.14 and 5.15) were not very numerous, but included remarks that ticket machine buttons were too high and that ticket barriers were too narrow, unreliable or simply difficult to use.

As noted above, Mr Martin Renouf was provided with a Travel Pass and a Wide Barrier Key during both his visits so that he did not have to purchase tickets or negotiate the turnstile barriers. He was able to use the wide barriers alone and unassisted and during the course of his visits, none of the wide barriers was found to have become jammed shut. When first installed, the wide barriers (along with the turnstile barriers) were all programmed to lock shut in case of failure, for example if the ticket acceptance and return mechanism had jammed. However, by the time of Mr Renouf's visit, the wide barriers had been altered to unlock in case of failure so that they can be swung freely in either direction. Mr Renouf was also able to use the exit doors at suburban stations without difficulty.

At the time of Mrs Alison Dudley's visit to Metro, raised metal strips were being fitted to the wide ticket barriers between the ticket insert and ticket return slots. Mrs Dudley thought this was quite useful for visually impaired people, most of whom would be eligible for a Concessionary Travel Permit incorporating the facility to open the wide barriers. She was less happy with the location of the wide barrier, which at Jesmond and several other stations was situated in the middle of the row of turnstile barriers so that anyone using it would tend to come into conflict with the main passenger flows through the station. This would expose visually impaired people to the risk of collision with other passengers. As Mrs Dudley had a Concessionary Travel Permit, she was unable to comment upon the ticket machines.

Mr Alan Rowley did remark upon the ticket machines during his visit since, although he had a Concessionary Travel Permit, some partially-sighted people who have sufficient residual sight not to qualify for one will need to use the ticket machines. He thought that the idea of colour-coding some of the fare buttons was helpful, since partially-sighted people might be able to distinguish the colours on the buttons even if they could not read the letters or numbers. He added that colour-coding could be used more extensively on the machines. However, the height of both the buttons and the instructions posed other problems. Mr Rowley pointed out that many partially-sighted people could only read material such as the list of stations and fare codes if these were presented directly at eye level and at a distance of a few inches. He realised that the required height would obviously vary for people of differing stature so this problem was seemingly insoluble, unless Concessionary Travel Permits were made available to all partially-sighted people.

In Figure 5.21, four of the suggestions concern ticketing arrangements. The request for a textured strip between the ticket insert and return slots on the wide barriers (Point 6) was agreed upon and raised metal strips were fitted as noted above. A low frequency warning system (Point 7) had been introduced on an experimental basis but had not proved successful and was withdrawn. The reliability of wide ticket barriers (Point 8) remains a contentious issue, but the fact that wide barriers will now unlock rather than jam shut in the case of failure should mean that the effects of breakdown are mitigated. Point 22 raised the question of the provision of wide barrier passes for people living outside Tyne and Wear.

Mr Alan Dudley pointed out that Concessionary Travel Permits, if used intensively, may wear out and hence not operate the wide barriers before their printed expiry date. He said that his Local Authority Social Services Department were often slow to authorise a replacement Permit when this occurred.

Figure 5.24 shows the answers given by respondents to the survey of wheelchair users in North Tyneside to questions on whether particular aspects of Metro caused difficulty. Very few respondents said they had problems with either ticket machines or with ticket barriers and a much larger number in both cases said they had no difficulty. However, over two-thirds of respondents replied that they had no experience of these aspects of Metro. Five respondents to this survey thought that ticket barriers were unreliable (Figure 5.25) and this problem also arose from the comments on specific stations (Figure 5.26).

The study by Robinson and Porter included the following points regarding ticket machines and barriers:

i) The volunteers who visited various Metro stations said that the wide ticket barriers were sometimes *situated near to obstructions* such as pillars, posts, etc. which made them difficult to use. This was particularly the case at Benton and Cullercoats;

ii) Some volunteers remarked that the exit doors, where provided, were easier to negotiate than the ticket barriers;

iii) Any disabled people without a Concessionary Travel Permit would have to purchase tickets from vending machines, but the control buttons and coin slot were inaccessible to wheelchair users and adults of restricted growth;

iv) A number of ambulant disabled volunteers also found the buttons and codes on ticket machines confusing;

v) There were some suggestions that all tickets and permits be encoded to open the wide barriers, in order to avoid the necessity of making special arrangements;

vi) All the visually impaired volunteers reported difficulty with locating the ticket insert and return slots on the wide barrier, but this was before the raised strips had been fitted;

vii) Some volunteers with arthritis and other complaints affecting the hands said that they had difficulty holding and using their Concessionary Travel Permits;

viii) Many of the visually impaired volunteers complained about the lack of standardisation in barrier location and layout at different stations;

ix) A "consistency survey" into the reliability of wide barriers and other items was undertaken to investigate allegations of "unacceptable" levels of unreliability. Wide barrier reliability was estimated at about 96% but the survey was carried out before the wide barriers were reprogrammed to unlock in case of failure.

11) Platforms

Bentzen et al made the following recommendations concerning station platforms:

i) All platform edges should have warning strips incorporating contrastingly coloured and textured markings;

ii) Litter bins should be placed so as not to cause obstruction;

iii) Poles and columns should wherever possible be sited away from areas of passenger movement.

These specifications are once again concerned only with the needs of visually impaired people, but the following analysis will also include points which are relevant to people with other disabilities.

With regard to platform edges, Plates 26 to 31 illustrate the variety of markings. Plate 26 shows the standard marking for new sub-surface stations, consisting of a 5° raised edge, a strip of contrastingly coloured and textured tiles and, on the actual edge, a strip of white textured paint. Most new surface stations have platform edges as shown in Plate 27, with two sets of grooves and a white-painted edge, but there are numerous variations as shown in Plates 28 to 31. Appendix I gives details of the platform edges at each station.

No comments regarding platforms emerged from the survey carried out for this thesis, or from Mr Renouf's visit. However, when Mrs Dudley visited Metro she remarked that the platform edge markings were really not relevant to the needs of visually impaired people since most such individuals would walk with extreme caution, often with a stick, cane, guide dog or escort, and were thus unlikely to step off the platform edge. She added that the expense and effort of providing these markings could have been more effectively directed elsewhere.

The Transport Users' Consultative Committee and the Newcastle upon Tyne Council for the Disabled were nevertheless concerned about platform edge markings and advocated greater consistency in this respect (Figure 5.21). Their recommendations also included requests for discussions on platform seating and for obstructions to be marked with contrasting colours.

No other comments on platforms emerged, except from the study by Robinson and Porter, which included the following:

i) Many visually impaired people did not find the existing platform markings were sufficiently contrasting even at new sub-surface stations while there was considerable variation at older surface stations;

ii) At sub-surface stations such as Haymarket, litter bins were fixed to the walls at intervals, at a height of 560mm (1 ft. 10 in.) above the floor, so that a visually impaired person might not notice them before bumping into one;

iii) Some ambulant disabled people thought that the standard "tip-up" seats on platforms were uncomfortable;

iv) Many visually impaired volunteers complained that obstructions such as pillars and posts were situated on platforms at older stations (notably South Gosforth, Longbenton, Monkseaton, Whitley Bay and Tynemouth) and suggested that these either be removed or painted in contrasting colours.

12) Identifying trains

This category is also mainly of concern to visually impaired people. Bentzen et al recommend the following:

i) Announcements of train destinations should be made at stations as trains arrive to enable visually impaired people to identify their desired trains without needing to ask other passengers;

ii) If trains remain standing in stations for long periods of time, visually impaired people might not be aware of the presence of a train. Announcements of trains about to depart should therefore be made in such instances if possible.

Virtually all the surveys and investigations involving visually impaired people indicate that spoken announcements at stations and on trains would be very welcome. Figure 5.4 gives the numbers and percentages of respondents to the survey carried out for this thesis who found train recognition easy or difficult. 70% of visually impaired respondents had problems in this respect, compared to between 16% and 28% of those in other groupings. The comments made by visually impaired respondents (Figure 5.12) show that eight wanted spoken announcements either at stations or on trains, this being the most often-mentioned complaint among visually impaired respondents. A cross-check with Figure 5.15 demonstrates that all the remarks relating to spoken announcements came from visually impaired people. One person also stated that it was difficult to see the names of smaller stations.

When Mrs Alison Dudley visited Metro, she emphasised that more audible cues were needed and the most important of these was the introduction of spoken announcements. She pointed out that since the number of different destinations on Metro was very small, announcements need not be lengthy or time-consuming, yet they would be of enormous benefit since visually impaired people would be able to identify and board trains with confidence. During her visit to Metro, Mrs Dudley used St James station, which is a terminal station with two platforms. There are no audible or tactile indications at concourse or platform level of whether there are trains at either or both platforms or, in the latter case, which train will depart first. The other terminal stations on the system, Bank Foot and South Shields, only have single platforms but as in the case of St James there is no audible indication of the presence of a train save for the buzzer to warn of impending door closure and some noise from the train's electrical equipment. However, once the door buzzer had sounded, there would not be enough time to board the train before the doors closed, while any noise from electrical equipment would be intermittent and may not be readily discernible as an indication of the presence of a train.

Many of Mr Alan Rowley's comments were similar to those made by Mrs Dudley. As Mr Rowley is partially-sighted, he could make out the words on the illuminated "next train" indicators, where these were provided, but was unable to read destination indicators on trains. During his visit, Mr Rowley emphasised that many visually impaired people were deterred from using Metro by fear either of having to ask for help or of becoming lost or stranded. The ability to find the correct train was an important element in this respect and he thought that spoken announcements would be of great benefit.

Further evidence of the need for announcements came from the discussions with representatives of the Transport Users' Consultative Committee and the Newcastle upon Tyne Council for the Disabled. Their list of suggested improvements to the facilities for disabled people on Metro (see Figure 5.21) also included improved marking and possible audible indication of train doors (Points 12 and 21) as well as the introduction of announcements at stations (Point 19). The remarks made by Mr Alan Dudley included a further request for announcements on trains. Robinson and Porter also stated that evidence from volunteers who visited Metro for their study showed that visually impaired people needed announcements both on trains and at stations. It would not have been possible to take account of the specifications given by Bentzen et al when the facilities on Metro were designed and built as these guidelines were published after most of the system was opened. However, public address equipment does exist both on trains and at stations, mainly for use in an emergency, so that the provision of regular spoken announcements might not require very great effort or expense.

13) Boarding Trains

Bentzen et al suggest the following:

i) Some form of audible indication should be provided to help visually impaired people locate train doors;

ii) The gap between platforms and trains can present a hazard and should be minimised.

Although there is at present no audible indication of the location of train doors, a green light above the door buttons is illuminated when it is safe to open the doors. The only audible indication is a buzzer to warn of impending door closure. According to Tyne and Wear PTE, the vertical step up into trains will vary between 65mm (2.5 in.) and 140mm (5.5 in.) while the horizontal gap will vary between about 100mm (4 in.) and 150mm (6 in.). These are both necessary for safety reasons: the horizontal gap to prevent a train side-swiping the platform and a vertical step to enable the plug-type doors to open outwards and along the sides of the train without grounding on the platform. Allowances have to be made for variations in track conditions, train loading and the state of the train air suspension, including a total failure which will result in the train "sagging" by a few inches. The only possible improvement would have been the use of doors which did not open outwards, in order to reduce the need for vertical clearance. However, any alternative door system would probably have been less reliable and more expensive.

Figure 5.7 gives the answers from respondents to the survey undertaken for this thesis to the question on whether train doors were easy or difficult to locate. Exactly 50% of visually impaired respondents who answered this question said they had difficulty while smaller percentages of respondents in other groupings reported problems. Figure 5.8 shows the results for the question on train entry/exit and in this case between 11% and 38% of respondents in the various groupings said they had difficulty. When the responses to these questions from wheelchair users were separated out, only a minority reported problems in each case. However, Figures 5.10 to 5.14 illustrate that some criticisms were levelled at both the train door buttons and at the train/platform gap, while a significant number of respondents also said that train doors closed too quickly, i.e. train dwell times at stations were too short. This would be expected since by definition most disabled people will not be able to move very quickly. In fact, Figure 5.15 shows that complaints about short dwell times constituted one of the most often-mentioned criticisms, when all respondents were taken together. A closer examination of the original remarks made on questionnaire forms revealed that some of those who complained of this problem appeared to be ignorant of the fact that safety devices will cause the train doors to re-open if they meet an obstruction and will also prevent the train from moving until all the doors are properly closed. Consequently, some of these comments may have been motivated by a fear of being dragged along the platform by a moving train. In any case, given that Metro is a "rapid" transit system, it is difficult to envisage any means by which dwell times at stations could be prolonged without causing disruption and delays.

Plates 32 to 35 show Mr Renouf entering and leaving a Metrocar at St James station: since trains terminate here, they usually remain stationary for long periods with doors open, thus affording the opportunity to take photographs without causing disruption. As Mr Renouf had sufficient strength to propel his wheelchair unassisted, he was able to enter the Metrocar without difficulty (Plate 32). He found it necessary to raise the small front wheels slightly and to balance momentarily on his large rear wheels in order to overcome the slight step up, but this did not pose any problems. Train exit, as illustrated in Plate 33, was also quite easy, although again Mr Renouf found it necessary to raise his front wheels slightly off the ground. When he attempted to enter and leave the Metrocar without doing this, he found that these small front wheels became stuck in the gap between train and platform (Plates 34 and 35). Although Mr Renouf was able to extricate himself from this situation without difficulty, this might not have been the case for someone with less strength.

The comments made by Mrs Alison Dudley naturally centred upon the problems encountered by visually impaired people, as already mentioned above. She said that she could not usually locate train doors but relied upon her guide dog to follow other passengers through the doors into the train. Difficulties therefore arose when few other passengers were present. Meanwhile, Mr Alan Rowley said that he could not locate the green light above train door buttons very easily as it was not sufficiently large or bright. He added that a white light would be more clearly discernible.

The only suggestion listed in Figure 5.21 regarding train entry and exit concerned the possibility of making train doors more easily identifiable, a point already raised above.

Figures 5.22 and 5.23 illustrate that, among respondents to the Newcastle City survey, there was a significant level of concern about train doors and short dwell times, both among Metro users and those who said they had not been on the system. Only a small minority of respondents to the survey of wheelchair users in North Tyneside said they had difficulty with train entry/exit (Figure 5.24) although over two-thirds stated that they had no experience in this respect. Nevertheless, short dwell times again emerged as a significant source of general criticism (Figure 5.25). The train/platform gap did not seem to be a particular problem: only one respondent made a remark on this matter and then only with regard to Longbenton station (Figure 5.26).

Robinson and Porter identified a number of stations where their volunteers claimed that a greater than average train/platform gap caused problems, especially to wheelchair users. These stations were West Jesmond, Longbenton, Four Lane Ends and Monkseaton, but since track maintenance and re-ballasting takes place from time to time throughout the system, this situation will tend to change. Other comments on train entry/exit were:

i) Most of the visually impaired volunteers said they had difficulty finding the train doors and door buttons. Some of the blind volunteers relied on their guide dogs to lead them through doors when they were open, assuming that other passengers had already opened them;

ii) Several volunteers were worried about the doors closing too quickly, but did not seem aware that the doors would open again if they encountered an obstruction and the train could not be started until all doors were properly closed. Robinson and Porter did not mention these safety measures either;

iii) It was also claimed that trains sometimes overshot or stopped short of platforms, but this problem has now been eliminated.

14) Train Interiors

The guidelines laid down by Bentzen and her colleagues cover most aspects of the design of rolling stock, but again only with regard to visually impaired people. Those points relevant to Metro are as follows:

i) Designated seats for disabled people should be provided in consistent locations near the doors on all trains;

ii) Announcements of the names of all stations should be made on trains to enable visually impaired people to identify their desired stop;

iii) When trains stop at stations, an audible warning should be given of the side of the train on which the doors would open so that visually impaired people could identify the correct side for exit. This audible warning should either consist of a signal located on or near the doors, or be included in spoken announcements.

The question of spoken announcements on trains and at stations has already been dealt with under the heading "Identifying Trains". Neither of the other two recommendations are complied with on Metro. Very few comments on train interiors were made by respondents to the survey carried out for this thesis except one complaint from a visually impaired person that there were not enough handrails (Figure 5.12) and one remark from an elderly wheelchair user that the vertical pole in the train vestibule area caused an obstruction (this comment occurs in both Figure 5.13 and Figure 5.14). One person also said that the buzzers were noisy (Figure 5.11) but this is probably a matter of personal preference rather than a result of disability.

Mr Renouf found train interiors to be quite satisfactory during his two visits. He thought that the trains gave quite a smooth ride and his wheelchair remained stable throughout, even when sharp curves or occasional stretches of uneven track were encountered, or when the train was accelerating or braking sharply.

Mrs Dudley's comments on train interiors concentrated on the lack of information for visually impaired people. When on a train, she was only able to tell which station had been reached by asking other passengers. Similarly, when she wanted to alight she had to rely on following other people since she could not locate the doors on her own, much less tell which side to open the doors and alight. While she realised that automatic locking devices prevent the doors on the "wrong" side being opened, she did point out that a visually impaired person could become confused and embarrassed by trying to open the wrong doors. These comments were echoed by Mr Alan Dudley, especially with regard to the problem of identifying stations during the journey. He said it was possible to count the number of stations to the desired destination but this required intense concentration which could be disrupted especially by trains stopping at signals between stations.

The answers given in Figure 5.24 by respondents to the survey of wheelchair users in North Tyneside suggest that the ride quality of trains was quite satisfactory. Only 2% of respondents said they had problems due to trains swaying while 30% stated that they had no difficulty in this respect. 68% had no experience of Metro travel.

Robinson and Porter raised the following points regarding trains:

i) The visually impaired volunteers reported less difficulty locating the door buttons and doors from inside the train than from on the platform, but some individuals said they often became disoriented and tried to open the doors on the wrong side;

ii) Problems with station identification also arose. A number of partially-sighted volunteers said they could read station names from inside trains but others claimed they could not. Blind volunteers mainly relied on trying to count the number of stations but were often distracted;

iii) Opinions on train ride quality varied. Some volunteers thought the trains were very smooth while others (especially wheelchair users) complained of vibration and jolting. Some wheelchair users said their wheelchairs did not remain stable on moving trains;

iv) Three of the 12 wheelchair users remarked that there was not enough room in train vestibule areas, mainly due to the central pole, and several wheelchair users suggested the removal of one or more seats to enable them to sit with other passengers;

v) Most of the volunteers said that drivers were very helpful to disabled passengers.

Finally, note should be taken of other unfavourable remarks about trains. Some respondents to the survey carried out for this thesis appeared to be worried by the speed of trains or by the fact that they do not have guards or conductors. It seems that these factors deterred some respondents from using Metro (Figures 5.16 and 5.17). Similar remarks were made by a few respondents to the Newcastle City survey and the survey of wheelchair users in North Tyneside (Figures 5.23 and 5.25). It may be that, for elderly disabled people, Metro compares unfavourably with the service provided in the past by British Rail, when running times were slower and more staff were available on trains and at stations. Rapid acceleration and braking will inevitably be characteristic of a system such as Metro and any slowing down of the service will naturally lead to delays. In any case, some respondents praised Metro for its speed and convenience (Figure 5.15). Automation and reduction in staff are also characteristic of modern rapid transit systems.

15) Other Factors

The above 14 sub-headings cover all the specifications made by Goldsmith, the American National Standards Institute and by Bentzen et al which are relevant to Metro. However, the various studies of the use of Metro by disabled people revealed a number of other points which will now be considered.

Some respondents to the survey carried out for this thesis complained that Metro was too crowded or that it was difficult not to hinder other passengers (Figures 5.12 to 5.15). Similar comments were given as reasons for non-use by a number of respondents (Figures 5.16 and 5.18). "Crowds" constituted the most often-mentioned general comment on Metro made by respondents to the survey of wheelchair users in North Tyneside (see Figure 5.25). However, it is difficult to envisage a solution to this problem, except by encouraging disabled people to travel during quieter periods.

The question of toilets at stations was also raised on various occasions. At present, there are no toilets within stations or on trains and very few stations have public toilets nearby (see Appendix I). Figure 5.21 shows that the Transport Users' Consultative Committee and the Newcastle upon Tyne Council for the Disabled had requested that toilets be provided (Point 28 on their list of suggestions). Some of the respondents to the survey of wheelchair users in North Tyneside also mentioned this point (Figure 5.25). It is important to note that some disabled people may be prone to incontinence and in any case due to restricted mobility may require toilets to be within easy reach. Robinson and Porter also stated that some of their disabled volunteers were concerned about the lack of toilets.

Tyne and Wear PTE have in the past argued that provision of toilets would prove very costly, especially with regard to the levels of vandalism which would probably prevail, given the experience with public toilets generally. The PTE have tried to encourage Local Authorities to provide toilets at or near stations but without success.

A number of the points raised under previous sub-headings also suggest that some disabled people were ignorant or unsure of many aspects of the system. Given that many disabled people are isolated from society, or will be reluctant to tackle anything new or unfamiliar, it may be that more publicity should be directed towards encouraging disabled people to use Metro, in addition to the leaflets and other information already provided.

Vandalism and hooliganism were also mentioned in some of the surveys (Figures 5.22, 5.23, 5.25 and 5.26), and it may well be that disabled people, especially the elderly, feel particularly vulnerable to attack. There were also a few comments on other subjects, most of which seem to be isolated remarks made only by one or two individuals.

This Section has dealt almost exclusively with comments arising from those disabled people who had used Metro, rather than with the opinions of non-users. These will be studied in the next Section.

## 5.4 Reasons for non-use of Metro and conclusions

The various points arising from the surveys and other investigations analysed in the previous Section should be placed in the perspective given by the fact that only a minority of disabled people actually use Metro. The respondents to the survey undertaken specifically for this thesis include a disproportionate number of Metro users: 64% of respondents said they had been on the system at some time. In contrast, the survey of disabled people carried out by the City of Newcastle upon Tyne (1985) showed much lower Metro use among disabled people. Only 32% of all respondents had used Metro (see Figure 3.20 of Chapter 3) and only 12% of all respondents used Metro once a week or more. By comparison, 63% of all respondents had used buses, and 40% used buses once a week or more. Figure 4.27 of Chapter 4 gives Metro use according to age/sex group and Figure 4.28 shows Metro use according to disability grouping, compared to that of respondents to the survey carried out for this thesis. As discussed in Section 5 of Chapter 4, Metro use declined with age and was also lower for females than for males. The percentages of people in each disability grouping in the Newcastle City survey are almost certainly more representative of disabled people generally than similar results for the survey carried out for this thesis.

Similarly, respondents to the survey of wheelchair users in North Tyneside are probably more representative of wheelchair users as a whole than are the wheelchair-using respondents to the survey undertaken by the author. In the former survey, 107 (or 34%) of the 325 respondents said they had used Metro while a total of 125 respondents (or 38%) stated that they had either been on Metro and intended to use it again, or had not been on Metro but planned to travel on it in future.

Not only are Metro users in a minority among disabled people, but it also appears that disabled people are under-represented among Metro passengers. According to Section 2 of Chapter 4, it seems that between 0.3% and 0.5% of Metro passengers are disabled. In contrast, the evidence presented in Chapter 3 suggests that between about 7% and 8% of the population of the Tyne and Wear area are disabled. This figure of 7% to 8% should be reduced to exclude disabled people unlikely ever to use Metro (for example car users and the housebound) and people with impaired hearing or mental disability. Given that the 1981 Census showed the population of Tyne and Wear to be about 1,140,000, it was estimated in Section 8 of Chapter 3 that between 60,000 and 67,000 (or about 5% to 6%) of the population of the area had some physical disability or visual impairment but were able to go outdoors. This 5% to 6% represents the basic "target group" for facilities for disabled people on Metro: against this, the estimate that at best 0.5% of Metro users are disabled seems rather dismal. Some of these 60,000 to 67,000 people will have cars, while others, although able to go outdoors, will only be able to travel for short distances. According to Section 8 of Chapter 3, the percentage of the Tyne and Wear population who are physically or visually disabled but who can walk or travel in a wheelchair for more than about 100 yards may be as low as 2.2% or 2.4%, i.e. about 24,600 to 27,500 people. Even this low figure is still considerably larger than the percentage of Metro passengers who are disabled. The aim of the above calculations is not to reduce the significance of the low use of Metro by disabled people, but to show that even the group of disabled people most likely to use Metro is still far larger than the actual percentage of

Metro users with some disability.

It therefore seems that the majority of disabled people in the Tyne and Wear area do not use Metro and it is also very probable that many of those disabled people who do travel on the system do so only rarely. Moreover, Metro use appears to vary between disability groupings, but it seems that the percentage of wheelchair users who have been on Metro is about the same as the percentage of disabled people as a whole who use the system. These conclusions raise two questions:

i) What factors prevent disabled people in different groupings from making greater use of Metro?

ii) What is the incidence among disabled people of different kinds of disability and how does this affect overall use of Metro by disabled people?

Probable answers to both these questions can be found quite readily. Respondents to the survey of disabled people carried out for this thesis who had not used Metro and/or did not possess a Concessionary Travel Permit were asked to give reasons (see Figure 4.16 in Chapter 4 for a copy of the questionnaire form). Results for some disability groupings plus elderly (aged over 65) respondents and wheelchair users are given in Figures 5.16 to 5.20. Results for other disability groupings are not given in tabular form due to the low numbers involved.

It is clear from all these tables that the main reasons for non-use of Metro and for not holding a Concessionary Travel Permit are mainly concerned with the inability to go out or to do so alone or with difficulty in travelling to and from stations. This latter problem would suggest a general inability to make longer journeys rather than any particular difficulties with Metro. The results from disability groupings containing smaller numbers of respondents (which are not given in tabular form) tend to show a similar pattern of answers.

A comparison with respondents who had used Metro is also worthwhile at this point. Figure 5.9 shows whether respondents in different groupings who had used Metro found that travel to stations was easy or difficult. Only a minority of respondents in each grouping reported difficulty but some of the general comments made by respondents (Figures 5.10, 5.11, 5.13, 5.14 and 5.15) are concerned with difficulties travelling to stations. However, Metro users are probably in a minority among disabled people.

Figure 5.22 gives details of the comments on Metro made by respondents to the Newcastle City survey who had used the system, while Figure 5.23 lists the reasons for non-use given by respondents who had not been on it. Remarks about the length of the journey to stations feature prominently in both figures. In Figure 5.24, details of difficulties with Metro experienced by respondents to the survey of wheelchair users in North Tyneside are given. Although only a minority of respondents said they had problems with the distance to or from the stations, the percentage reporting difficulty was larger than for almost all of the other items listed.

The implication of the above results is clear: about two-thirds of disabled people in Tyne and Wear do not use Metro and the main factors responsible for this appear to be general mobility problems rather than factors concerned with the system. Consequently, the most effective means of increasing the use of Metro by disabled people will probably be to improve the overall mobility of those disabled people who do not at present travel on the system. This does not imply that there is no point in improving the facilities for disabled people on Metro. Evidence suggests that those who currently use the system tend to do so only infrequently and the main difficulties encountered by disabled Metro users are related more to the system itself than to general mobility problems. Consequently, any programme of improving the mobility of disabled people so that more will use Metro should be complemented by improvements to the system itself in order to maintain this increased mobility and to encourage regular rather than occasional use. Section 3 of this Chapter gives details of the parts of Metro where improvements are most needed.

Having answered the first of the questions posed earlier in this Section, the second question can also be tackled, i.e. what is the incidence, among disabled people, of different kinds of disability and how does this affect overall use of Metro by disabled people? Rather than attempting to disaggregate disabled people into disability groupings according to diseases, it is probably more useful to disaggregate them according to "functional" disability, i.e. into the categories of ambulant disabled, wheelchair users and visually impaired. It will be remembered that the following estimates were given in Figures 3.36 and 3.41 of Chapter 3:

i) 8% of disabled people in the Tyne and Wear area able to go out are visually impaired;

ii) Between 4% and 9% of disabled people in the Tyne and Wear area able to go out are wheelchair users, although 9% may be an overestimate. About 77% of wheelchair users are confined to a wheelchair.

This implies that the remaining 83% to 88% of disabled people are ambulant disabled, due to some other disability than visual impairment.

There will be some overlap due to the fact that the three categories are not mutually exclusive but the overall picture is clear: the vast majority of disabled people are ambulant disabled while considerably smaller percentages use a wheelchair or have some visual impairment. Consequently, any measures designed to enhance the use of Metro by ambulant disabled people would probably have the greatest impact upon the overall numbers of disabled people using Metro. However, it is not always easy to ascertain which particular facilities on Metro are of benefit especially to ambulant disabled people as opposed to visually impaired people or wheelchair users, since almost all the facilities are used by disabled people in all three categories. What is more certain is that only a minority of disabled people of all kinds use Metro, and the majority of disabled people who do not use Metro are prevented from doing so largely by poor overall mobility rather than any factors concerning Metro itself.

In the light of the above information, it is pertinent to ask whether there was much point in providing facilities for disabled people on Metro at all. Might not some other form of transport, such as a wheelchair-accessible dial-a-ride minibus service have been more appropriate given that use of Metro by disabled people tends to be a function of overall mobility? In other words, the disabled people who do use Metro are the more mobile individuals who would go out more than most disabled people anyway, while the majority of disabled people, who cannot travel very far or go out often, seem to remain in the same situation as they were before Metro was opened. A general scheme to improve the mobility of disabled people, such as a minibus service of the kind mentioned above, might therefore benefit a greater number of disabled people and also obviate the need for facilities on Metro, since all such individuals would be able to use it, irrespective of how often they went out by other means. While this might seem an attractive proposition, there are a number of factors which would argue against such a policy. These will be discussed in Chapters 6 and 7.

One other point of interest emerges from the ergonomic analysis carried out in this Chapter. As mentioned earlier, the specifications given by Goldsmith (1976) were used to evaluate the facilities on Metro but it was not originally intended that the ergonomic analysis should be used to assess the value of Goldsmith's work. However, it does seem that where the facilities on Metro comply with Goldsmith, they perform more satisfactorily than in instances where they do not meet his specifications (although there are one or two exceptions to this). It therefore emerges that the analysis carried out in this Chapter suggests that Goldsmith accurately reflects the abilities and needs of disabled people. Facilities designed in compliance with his recommendations will therefore adequately meet the requirements of the disabled people for whom they are intended.

Figures - Chapter 5

Figures - Chapter 5 (continued)

Figure 5.1 : Numbers and percentages of questionnaire survey respondents in different groupings finding ticket machines easy or difficult

| Grouping | No. (and %) of respondents in grouping finding use of ticket machines | | |
|---|---|---|---|
| | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 6 (20) | 13 (43) | 11 (37) |
| Diseases of bones and organs of movement | 12 (48) | 7 (28) | 6 (24) |
| Visual impairment | 10 (35) | 3 (10) | 16 (55) |
| Elderly (aged over 65) | 15 (42) | 7 (19) | 14 (39) |

Figure 5.2 : Numbers and percentages of questionnaire survey respondents in different groupings finding ticket barriers easy or difficult

| Grouping | No. (and %) of respondents in grouping finding use of ticket barriers | | |
|---|---|---|---|
| | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 17 (46) | 13 (35) | 7 (19) |
| Diseases of bones and organs of movement | 13 (46) | 9 (32) | 6 (22) |
| Visual impairment | 22 (55) | 7 (18) | 11 (27) |
| Elderly (aged over 65) | 19 (44) | 12 (28) | 12 (28) |

Percentage figures refer to percentages of valid responses in all cases.

Results not given for the following disability groupings due to low numbers involved:

Diseases of the circulatory system.
Injuries and amputations.
Diseases of the respiratory system.

Figure 5.3 : Numbers and percentages of questionnaire survey respondents in different groupings finding orientation within stations easy or difficult

| Grouping | No. (and %) of respondents in grouping finding orientation within stations | | |
|---|---|---|---|
| | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 12 (35) | 10 (30) | 12 (35) |
| Diseases of bones and organs of movement | 9 (35) | 11 (42) | 6 (23) |
| Visual impairment | 8 (22) | 6 (17) | 22 (61) |
| Elderly (aged over 65) | 15 (39) | 15 (39) | 9 (22) |

Figure 5.4 : Numbers and percentages of questionnaire survey respondents in different groupings finding recognition of train destination easy or difficult

| Grouping | No. (and %) of respondents in grouping finding recognition of train destination | | |
|---|---|---|---|
| | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 12 (36) | 12 (36) | 9 (28) |
| Diseases of bones and organs of movement | 12 (46) | 9 (35) | 5 (19) |
| Visual impairment | 8 (22) | 3 ( 8) | 25 (70) |
| Elderly (aged over 65) | 19 (50) | 13 (34) | 6 (16) |

Percentage figures refer to percentages of valid responses in all cases.

Results not given for the following disability groupings due to low numbers involved:

Diseases of the circulatory system.
Injuries and amputations.
Diseases of the respiratory system.

Figure 5.5 : Numbers and percentages of questionnaire survey respondents in different groupings finding lift entry/exit easy or difficult

| Grouping | No. (and %) of respondents in grouping finding lift entry/exit | | |
|---|---|---|---|
| | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 13 (37) | 7 (20) | 15 (43) |
| Diseases of bones and organs of movement | 11 (42) | 7 (27) | 8 (31) |
| Visual impairment | 20 (59) | 5 (15) | 9 (26) |
| Elderly (aged over 65) | 18 (47) | 7 (18) | 13 (34) |

Figure 5.6 : Numbers and percentages of questionnaire survey respondents in different groupings finding lift buttons easy or difficult

| Grouping | No. (and %) of respondents in grouping finding lift buttons | | |
|---|---|---|---|
| | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 18 (50) | 9 (25) | 9 (25) |
| Diseases of bones and organs of movement | 8 (32) | 7 (28) | 10 (40) |
| Visual impairment | 14 (44) | 5 (15) | 13 (41) |
| Elderly (aged over 65) | 15 (41) | 9 (24) | 13 (35) |

Percentage figures refer to percentages of valid responses in all cases.

Results not given for the following disability groupings due to low numbers involved:

Diseases of the circulatory system.
Injuries and amputations.
Diseases of the respiratory system.

Figure 5.7 : Numbers and percentages of questionnaire survey respondents in different groupings finding opening train doors easy or difficult

| | No. (and %) of respondents in grouping finding opening train doors | | |
|---|---|---|---|
| Grouping | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 10 (29) | 9 (27) | 15 (44) |
| Diseases of bones and organs of movement | 11 (44) | 5 (20) | 9 (36) |
| Visual impairment | 12 (38) | 4 (12) | 16 (50) |
| Elderly (aged over 65) | 14 (39) | 8 (22) | 14 (39) |

Figure 5.8 : Numbers and percentages of questionnaire survey respondents in different groupings finding train entry/exit easy or difficult

| | No. (and %) of respondents in grouping finding train exit/entry | | |
|---|---|---|---|
| Grouping | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 13 (35) | 10 (27) | 14 (38) |
| Diseases of bones and organs of movement | 12 (44) | 6 (22) | 9 (34) |
| Visual impairment | 18 (67) | 6 (22) | 3 (11) |
| Elderly (aged over 65) | 20 (47) | 7 (16) | 16 (37) |

Percentage figures refer to percentages of valid responses in all cases.

Results not given for the following disability groupings due to low numbers involved:

Diseases of the circulatory system.
Injuries and amputations.
Diseases of the respiratory system.

Figure 5.9 : Numbers and percentages of questionnaire survey respondents in different groupings finding travel to Metro stations easy or difficult

| | No. (and %) of respondents in grouping finding travel to Metro stations | | |
|---|---|---|---|
| Grouping | Easy | Neither easy nor difficult | Difficult |
| Diseases of Central Nervous System | 12 (31) | 12 (31) | 15 (38) |
| Diseases of bones and organs of movement | 12 (42) | 8 (29) | 8 (29) |
| Visual impairment | 21 (57) | 6 (16) | 10 (27) |
| Elderly (aged over 65) | 20 (44) | 9 (20) | 16 (36) |

Percentage figures refer to percentages of valid responses in all cases.

Results not given for the following disability groupings due to low numbers involved:

Diseases of the circulatory system.
Injuries and amputations.
Diseases of the respiratory system.

Figure 5.10 : General comments on Metro by questionnaire survey respondents with CNS diseases

| Comment | No. of respondents making comment |
|---|---|
| Lifts are too small | 4 |
| Lifts are dirty | 1 |
| No lifts at some stations | 1 |
| Gap between train and platform is too large | 3 |
| Cannot use Metro alone | 2 |
| Too far to the station | 2 |
| Ramps are too steep | 2 |
| Ramps at older stations are too steep | 1 |
| Ramp at Walkergate is too steep | 1 |
| Ramps are in poor condition | 1 |
| Not enough ramps | 1 |
| Insufficient time to board train | 1 |
| Tyne and Wear PTE have a responsibility to encourage disabled people to use Metro | 1 |
| Ticket machine buttons should be lower | 1 |
| Can only use Metro if Dial-a-Ride used to reach station | 1 |
| Could be more accessible for disabled people | 1 |
| Difficult to cross tracks at Whitley Bay | 1 |
| Felling station is inadequately lit | 1 |
| Metro is "smashing" | 1 |

Total number of comments exceeds the number of respondents making comments as some respondents made more than one comment.

Figure 5.11 : General comments on Metro by questionnaire survey respondents with diseases of bones and organs of movement

| Comment | No. of respondents making comment |
|---|---|
| Quick/pleasant means of transport | 5 |
| Doors are not open long enough | 5 |
| Can only use Metro if accompanied | 4 |
| Not enough lifts at stations in Newcastle | 3 |
| Lifts are too small | 3 |
| Lifts are dirty | 2 |
| Lifts are unreliable | 1 |
| Difficult to locate lift buttons | 1 |
| Can only use Metro if uses lift | 1 |
| Some ramps are too steep | 1 |
| Not enough ramps | 1 |
| Ramps are in poor condition | 1 |
| Ramps at Monkseaton and Walkergate are steep | 1 |
| Escalators are unreliable | 1 |
| Step into train is difficult | 1 |
| Easier than buses | 1 |
| Drivers are always helpful | 1 |
| Station is too far away | 1 |
| Buzzers are noisy | 1 |

Total number of comments exceeds the number of respondents making comments as some respondents made more than one comment.

Figure 5.12 : General comments on Metro by visually impaired questionnaire survey respondents

| Comment | No. of respondents making comment |
|---|---|
| Spoken announcements on trains required | 5 |
| Metro not practical for visually impaired people | 4 |
| Spoken announcements at stations required | 3 |
| Insufficient time to board trains | 3 |
| Wider ticket barriers required | 2 |
| Uniform layout at stations required | 2 |
| Uniform layout of lift buttons required | 2 |
| Metro is too crowded | 2 |
| More handrails required | 1 |
| Ticket machines difficult to use | 1 |
| Gateshead station difficult | 1 |
| Colour contrasts on step edges required | 1 |
| Lifts are too small | 1 |
| Lifts are unreliable | 1 |
| Train door buttons are difficult to find | 1 |
| Felling station is very icy in winter | 1 |
| Felling station is poorly lit | 1 |
| Unable to use Metro in electric wheelchair | 1 |
| There is no-one to ask for help | 1 |
| I avoid stations with steps | 1 |
| Buses are easier | 1 |
| Quick, comfortable and frequent | 1 |
| Super | 1 |
| No problems | 1 |

Total number of comments exceeds the number of respondents making comments as some respondents made more than one comment.

Figure 5.13 : General comments on Metro by elderly questionnaire survey respondents

| Comment | No. of respondents making comment |
|---|---|
| Lifts are too small | 8 |
| Cannot use Metro alone | 6 |
| Train doors close too quickly | 5 |
| Quick and comfortable | 3 |
| Too far to nearest Metro station | 2 |
| Lifts are dirty | 2 |
| Lifts are unreliable | 2 |
| Ramps are too steep | 2 |
| Ramps are in poor condition | 2 |
| Not enough ramps | 1 |
| Walkergate ramp is too steep | 1 |
| Ramps at older stations are too steep | 1 |
| Not enough lifts at stations in Newcastle | 1 |
| Must use lift | 1 |
| Avoids stations with steps | 1 |
| Very confusing for visually impaired people | 1 |
| Cannot see names of smaller stations | 1 |
| Gets in the way of other users | 1 |
| Centre pole in vestibule area is awkward | 1 |
| Crowded | 1 |
| Can only get to Metro by using Dial-a-Ride | 1 |
| Gap between train and platform edge is too great | 1 |
| Difficult to cross tracks at Whitley Bay | 1 |
| Afraid of ticket barriers | 1 |
| Super for disabled people | 1 |
| No problems | 1 |
| Easier than buses | 1 |
| Would like to try Metro | 1 |

Total number of comments exceeds the number of respondents making comments as some respondents made more than one comment.

Figure 5.14 : General comments on Metro by wheelchair-using questionnaire survey respondents

| Comment | No. of respondents making comment |
|---|---|
| Lifts are too small | 8 |
| Cannot use Metro alone | 7 |
| Gap/step between platform and train too big | 4 |
| Ramps at some stations are too steep | 3 |
| Walkergate ramp is too steep | 2 |
| Some ramps are in poor condition | 2 |
| Train doors close too quickly | 2 |
| Super | 2 |
| Quick | 2 |
| Lifts are unreliable | 2 |
| Lifts are dirty | 2 |
| Not enough lifts at stations in Newcastle | 1 |
| Not enough stations with lifts | 1 |
| Should be two lifts at Monument | 1 |
| Cannot use lift buttons alone | 1 |
| Nearly all ramps are too steep | 1 |
| Not enough ramps | 1 |
| Cannot manage ramps alone | 1 |
| Monkseaton ramp is too steep | 1 |
| Older station ramps are too steep | 1 |
| Wide barriers unreliable | 1 |
| Cannot use wide barriers alone | 1 |
| Cannot use barriers in electric wheelchair | 1 |
| Difficult to cross tracks at Whitley Bay | 1 |
| Difficult not to hinder other users | 1 |
| Centre pole in vestibule area causes problems | 1 |
| Super for disabled people | 1 |
| Could be more accessible for disabled people | 1 |
| Would use Metro if helped | 1 |
| Would like to try Metro | 1 |
| PTE should encourage disabled people to use Metro | 1 |
| Buzzers are noisy | 1 |
| Can only get to Metro station by Dial-a-Ride | 1 |
| Metro only serves limited area | 1 |
| Drivers are very helpful | 1 |

Total number of comments exceeds the number of respondents making comments as some respondents made more than one comment.

Figure 5.15 : General comments on Metro made by all questionnaire survey respondents

| Comment | No. of respondents making comment | |
|---|---|---|
| 1) Lifts | | |
| Lifts are too small | 8 | |
| Lifts are unreliable | 4 | |
| Lifts are dirty | 3 | |
| Not enough lifts at stations in Newcastle | 2 | |
| There should be two lifts at Monument | 2 | |
| More uniformity required in layout of lift buttons | 2 | |
| Cannot use lift buttons alone | 1 | |
| Difficult to use lift buttons | 1 | |
| Lifts are awkward for blind people | 1 | |
| Has to use lift | 1 | |
| Lifts are crowded | 1 | |
| Not enough stations with lifts | 1 | |
| No lifts at some stations | 1 | Total 28 |
| 2) Train entry/exit | | |
| Train doors are not open for long enough | 12 | |
| Gap between train and platform is too big | 4 | |
| Difficult to find train door buttons | 2 | |
| Central pole in vestibule is an obstruction | 1 | |
| Buzzers are noisy | 1 | |
| Not enough grab rails inside trains | 1 | Total 21 |
| 3) Favourable comments | | |
| Quick | 6 | |
| Frequent | 3 | |
| Comfortable | 2 | |
| Pleasant | 2 | |
| Drivers very helpful | 1 | |
| Easier than buses | 1 | |
| Super for disabled people | 1 | |
| Smashing | 1 | |
| No problems | 1 | |
| Would like to try Metro | 1 | Total 19 |
| 4) Ticketing/ticket barriers/information | | |
| Spoken announcements are required | 8 | |
| Ticket barriers should be wider | 2 | |
| Barriers deter from using Metro | 1 | |
| How can barriers be used in electric wheelchair? | 1 | |
| Difficult to use ticket machines | 1 | |
| Ticket machines should be lower | 1 | |
| Wide barriers are unreliable | 1 | Total 15 |

Figure 5.15 (continued)

| Comment | No. of respondents making comment | |
|---|---|---|
| **5) Ramps** | | |
| Some ramps are too steep | 3 | |
| Some ramps are in poor condition | 2 | |
| Walkergate ramp is too steep | 2 | |
| Monkseaton ramp is too steep | 1 | |
| Nearly all ramps are too steep | 1 | |
| Older station ramps are too steep | 1 | |
| Unable to manage ramps alone | 1 | |
| Not enough ramps | 1 | Total 12 |
| **6) General and specific comments on stations** | | |
| More uniformity in station layouts required | 2 | |
| Avoids stations with steps | 1 | |
| No handrails at stations | 1 | |
| Gateshead station difficult to use due to number of levels | 1 | |
| Difficult to cross tracks at Whitley Bay | 1 | |
| Felling station is inadequately lit | 1 | |
| Felling station is icy in winter | 1 | |
| Ilford Road station is icy in winter | 1 | Total 9 |
| **7) Escorts** | | |
| Cannot use Metro alone | 8 | |
| Would use Metro if helped | 1 | Total 9 |
| **8) Reaching the stations** | | |
| Too far from home to station in wheelchair | 2 | |
| Might use Metro if stations were nearer | 1 | |
| Has to use Dial-a-Ride to get to station | 1 | |
| Metro only serves limited area | 1 | Total 5 |
| **9) Other users** | | |
| Metro is crowded | 3 | |
| Difficult not to hinder other users | 1 | Total 4 |
| **10) Other (unfavourable) comments** | | |
| Visually impaired have great difficulty | 4 | |
| Afraid of Metro | 1 | |
| PTE should encourage disabled people to use Metro | 1 | |
| Could be more accessible for disabled people | 1 | |
| Buses are easier | 1 | |
| Cannot use escalators | 1 | |
| Step edges should have colour contrasts | 1 | |
| Cannot see names of minor stations | 1 | |
| Escalators are unreliable | 1 | Total 12 |

Total number of comments exceeds the number of respondents making comments as some respondents made more than one comment.

Figure 5.16 : Reasons for non-use of Metro given by questionnaire survey respondents with diseases of bones and organs of movement not intending to use Metro in future

| Reason | No. of respondents giving reason |
|---|---|
| Cannot/will not go out | 4 |
| Cannot/will not use Metro | 4 |
| Station too far away | 3 |
| Desired destinations are within walking distance | 2 |
| Cannot/will not go out alone | 1 |
| Afraid Metro would be too crowded | 1 |
| Afraid of speed of Metro | 1 |
| Afraid because Metro trains have no guard | 1 |
| Difficulty with ticket machines (has used) | 1 |
| Metro is of no use | 1 |

Total number of reasons exceeds the number of respondents giving reasons as some respondents gave more than one reason.

Figure 5.17 : Reasons for non-use of Metro given by elderly questionnaire survey respondents not intending to use Metro in future

| Reason | No. of respondents giving reason |
|---|---|
| Cannot/will not go out | 6 |
| Cannot use Metro | 6 |
| Nearest station too far away | 6 |
| Cannot/will not go out alone | 2 |
| Desired destinations within walking distance | 2 |
| Afraid of speed | 2 |
| Afraid because Metro is unstaffed | 1 |
| Afraid | 1 |
| Cannot use Metro alone | 1 |
| Cannot get to station alone | 1 |
| Cannot use stairs/lifts alone | 1 |
| No use | 1 |
| Don't want to | 1 |
| Don't know | 1 |

Figure 5.18 : Reasons for non-use of Metro given by wheelchair-using questionnaire survey respondents not intending to use Metro in future

| Reason | No. of respondents giving reason |
|---|---|
| Nearest Metro station is too far away | 4 |
| Cannot use Metro | 3 |
| Desired destinations within walking distance | 2 |
| Cannot/will not go out | 2 |
| Cannot/will not go out alone | 1 |
| Afraid Metro will be too busy | 1 |
| Wallsend ramp is too steep | 1 |
| Needs door-to-door transport | 1 |
| No need | 1 |

Total number of reasons exceeds the number of respondents giving reasons as some respondents gave more than one reason.

Figure 5.19 : Reasons for not holding a Concessionary Travel Permit given by elderly questionnaire survey respondents

| Reason | No. of respondents giving reason |
|---|---|
| Cannot/will not go out | 6 |
| Cannot/will not go out alone | 4 |
| Permit has expired - has not renewed it | 3 |
| Nearest Metro station too far away | 2 |
| No need/has alternative mode | 2 |
| Cannot go out to renew Permit | 1 |
| Cannot use public transport | 1 |

Figure 5.20 : Reasons for not holding a Concessionary Travel Permit given by wheelchair-using questionnaire survey respondents

| Reason | No. of respondents giving reason |
|---|---|
| No need - has a car | 6 |
| Nearest Metro station too far away | 4 |
| Permit expired and not renewed | 4 |
| Cannot/will not go out | 3 |
| Cannot/will not use public transport | 3 |
| Cannot/will not go out alone | 2 |
| Does not use Metro often | 1 |
| Does not know how to apply | 1 |
| Uses taxis | 1 |
| Does not live in Tyne and Wear | 1 |
| Does not know | 1 |

Total number of reasons exceeds the number of respondents giving reasons as some respondents gave more than one reason.

Figure 5.21 : Suggestions for improvements to the facilities for disabled people on Metro, as made by the Transport Users' Consultative Committee for the North-East and the Newcastle upon Tyne Council for the Disabled, March 1984

1) Dropped kerbs to be provided in the vicinity of stations.

2) Repairs to be carried out to uneven walkways.

3) Extra-wide bays to be provided at parking spaces for disabled car users.

4) Level access to be provided between parking bays and station entrances.

5) Design of push buttons on lifts to be examined regarding the possibility of improvements.

6) Provision of textured strip between "in" and "out" slots on the wide ticket barrier.

7) Low frequency warning system on wide barrier for identification by guide dogs.

8) Discussions on response times when ticket barriers are out of order.

9) Alterations to photographic kiosk at Monument station to permit use by disabled people.

10) Discussions on platform seating.

11) Improvements to the signing of lifts at Central station.

12) Discussions on easier identification of train doors for partially sighted.

13) Colour marking of obstructions.

14) Marking out of walkways in stations.

15) Telephone facilities, accessible to disabled people, on stations.

16) Discussions on location of direction and information indicators.

17) Design of stairway handrails to continue the full length of flights of steps and to return to wall at end.

18) Marking of escalator steps.

19) Emergency communication at stations and station announcements.

Figure 5.21 (continued)

20) Position of emergency push buttons in trains.

21) Possibility of audible warning of location of train doors.

22) Easier provision of wide barrier passes for those living outside Tyne and Wear.

23) Relocation of parking bays at Four Lane Ends station to bus station area.

24) Tactile surface at top of stairways.

25) Publication of fully descriptive booklet listing the facilities on Metro.

26) Provision for disabled people in reconstruction of Tynemouth station.

27) Alterations to handrails at North Shields and provision of dropped kerbs.

28) Toilets at stations.

29) Improvements to ramps at older stations.

30) Textured platform edges at all stations.

31) Improved shelters at North Shields and Byker and at bus stations at Four Lane Ends and Heworth.

Figure 5.22 : Comments on Metro made by respondents to the Newcastle City survey who had used the system

| Comment | No. of respondents making comment |
|---|---|
| Long way to Metro | 6 |
| Afraid of doors closing too quickly | 5 |
| Dislikes escalators | 4 |
| Afraid of hooligans | 3 |
| Other transport available so uses Metro rarely | 2 |
| Gets breathless due to stairs and ramps | 2 |
| Bus serves most of desired destinations | 1 |
| Stations are cold | 1 |
| Handrails are slippery when wet | 1 |
| Frightened | 1 |
| Awkward due to stiff foot | 1 |
| No lift at Central Station | 1 |
| Long way round to change platforms | 1 |
| Ramps are too steep | 1 |
| Not enough ramps | 1 |
| Cannot use Metro alone | 1 |
| Difficulty boarding Metro | 1 |

Figure 5.23 : Reasons for not using Metro given by respondents to the Newcastle City survey who had not used the system

| Reason | No. of respondents giving reason |
|---|---|
| Metro is too far away | 8 |
| Difficulty getting on/off Metro | 5 |
| Afraid of escalators | 3 |
| Afraid of hooligans | 3 |
| Afraid of doors closing too quickly | 2 |
| Disabled spouse cannot use Metro | 2 |
| Car is available | 2 |
| Bus is easier | 1 |
| Frightened by crashes | 1 |
| Too fast | 1 |
| Too crowded | 1 |
| Stiff leg is awkward on public transport | 1 |
| Difficulty with steps | 1 |
| Cannot use Metro alone | 1 |
| Does not go out often | 1 |
| Tunnels are too deep | 1 |

Figure 5.24 : Difficulties using Metro experienced by respondents to the survey of wheelchair users in North Tyneside

No. (and %) of valid responses in category

| Aspect of Metro | Difficulties mentioned Unprompted | Prompted | No difficulty | No experience |
|---|---|---|---|---|
| Distance to/from Metro station | 44 (14) | 15 ( 5) | 75 (24) | 180 (57) |
| Kerbs or ramps on way to Metro station | 35 (11) | 26 ( 8) | 56 (18) | 197 (63) |
| Busy roads on way to Metro station | 2 ( 1) | 5 ( 2) | 97 (31) | 210 (66) |
| Ticket machines | 2 ( 1) | 2 ( 1) | 87 (28) | 221 (70) |
| Ticket barriers | 14 ( 4) | 8 ( 3) | 78 (25) | 214 (68) |
| Using the lifts (except lift buttons - see below) | 6 ( 2) | 3 ( 1) | 75 (24) | 230 (71) |
| Lift buttons | 0 ( 0) | 1 ( 1) | 81 (26) | 232 (73) |
| Train entry/ exit | 14 ( 4) | 3 ( 1) | 83 (26) | 214 (69) |
| Train swaying during journey | 3 ( 1) | 6 ( 2) | 92 (29) | 213 (68) |

Percentage figures refer to percentages of valid responses in all cases.

Figure 5.25 : Comments on Metro made by respondents to the survey of wheelchair users in North Tyneside

| Comment | No. of respondents making comment | No. of respondents making comment as % of total No. of respondents making comment |
|---|---|---|
| Crowds | 14 | 21 |
| Did not use wheelchair on Metro | 11 | 16 |
| Not enough time to get on/off | 6 | 9 |
| Ramps (generally) | 6 | 9 |
| Barriers unreliable | 5 | 7 |
| No toilets | 5 | 7 |
| Lifts are too small | 4 | 6 |
| Lifts are unreliable | 3 | 4 |
| Afraid to use Metro | 3 | 4 |
| Likes Metro | 3 | 4 |
| Metro is too fast | 2 | 3 |
| Wheelchair is unstable on Metro | 2 | 3 |
| Afraid to use Metro due to vandalism | 1 | 1 |
| Other (unfavourable) comment | 12 | 18 |

Percentage figures refer to percentages of valid responses in all cases.

Percentage total exceeds 100 due to some people making more than one comment.

Figure 5.26 : Metro Stations used by respondents to the survey of wheelchair users in North Tyneside, together with comments on these stations

| Station | No. of respondents using station | Comment | No. of respondents making comment |
|---|---|---|---|
| Wallsend | 10 | Ramp too steep. | 8 |
| | | Wide barrier unreliable. | 2 |
| North Shields | 9 | Ramp too steep. | 3 |
| | | Vandalism. | 1 |
| | | Kerbs poor. | 1 |
| | | Difficult to use. | 1 |
| Whitley Bay | 8 | Ramps too steep. | 4 |
| | | Footpath in poor condition. | 1 |
| Four Lane Ends | 8 | Ramps too steep. | 4 |
| Monkseaton | 8 | Ramps too steep. | 8 |
| | | Difficult to change platforms. | 1 |
| Longbenton | 7 | Ramp too steep. | 3 |
| | | Ramp acceptable. | 1 |
| | | Cannot use. | 1 |
| | | Gap between platform and train wide. | 1 |
| Tynemouth | 6 | Ramps too steep. | 1 |
| | | Long way round to change platforms | 1 |
| Cullercoats | 5 | High kerbs. | 1 |
| | | Difficult to change platforms. | 1 |
| Benton | 4 | Difficult to change platforms. | 1 |
| Shiremoor | 3 | Ramps too steep. | 3 |
| Percy Main | 3 | Ramps too steep. | 1 |
| Haymarket | 2 | | |
| Howdon | 2 | | |
| Hadrian Road | 1 | Good station. | 1 |
| Smith's Park | 1 | Vandalism. | 1 |
| West Monkseaton | 1 | Ramp too steep. | 1 |
| Monument | 1 | | |
| Regent Centre | 1 | | |

The total number of comments made at some stations exceeds the number of respondents using the station since some respondents made more than one comment on a station.

Not all respondents who said they had used particular stations made comments thereon.

# CHAPTER 6 :

# EVALUATION OF THE COST-EFFECTIVENESS OF THE FACILITIES FOR DISABLED PEOPLE ON METRO

## 6.1 Techniques of investment appraisal and social cost-benefit analysis

In order to undertake an assessment of the cost-effectiveness of the facilities for disabled people on Metro, it is first necessary to outline the techniques used in both the appraisal of investment and also in social cost-benefit analysis. Dealing firstly with investment appraisal, the principles involved are well described in "Economics and Transport Policy" by Gwilliam and Mackie (1975) and in "The Practice of Transport Investment Appraisal" by Button and Pearman (1983). These authors point out that investment involves the commitment of a large input of resources in the present in order to reap benefits (returns) in the future. If the appraisal is based on purely commercial criteria, the only question which need be asked is whether there will eventually be a profit on the capital invested. This, however, leads on to the question of how profit can be calculated and at this point it should be noted that all investment involves opportunity cost - if capital is invested then the opportunity of using it for consumption now is lost. Any rational individual will prefer consumption now to consumption later, all things being equal, and this will be the case even if inflation and uncertainty are not taken into consideration. In order for income later to be more attractive than income now, future income must be higher. For example, receipt of £100 now will be preferable to £100 in a year's time, but £107 in a year's time may be preferable to £100 now. If this is the case, it could then be calculated that the prospect of £100 in a year's time is only worth about £93 at present, while £100 in two years' time is only worth about £86 now (all values are expressed in current prices).

In any investment project, future benefits (and costs) must be discounted back to the present in terms of what each year's benefits are worth now. For example, if the annual benefits remain constant in numerical terms at current prices, their present value, when discounted, decreases over time.

If investment decisions are based on purely commercial criteria, i.e. where the aim is to maximise profits, a decision on whether to invest or not would be taken according to whether the sum of all the returns at current prices, discounted back to the present, using some suitable discount rate, exceeded the original investment. Similarly, if a limited amount of capital could be invested in a number of alternative schemes, the total value at present of each scheme could be calculated and investment directed towards the scheme with the highest total present value. However, Button and Pearman (1983), among others, point out that while some transport investment decisions are taken according to commercial criteria, transport is a public good and as such constitutes an important part of the production process, as well as providing individuals with access to work and leisure. Moreover, many transport projects have what are called cross-sector costs and benefits in that individuals and groups other than the investors and users are affected, beneficially or otherwise. If transport investment was made according to a calculation of total value at present on commercial grounds, then transport services would be allocated purely on the strength of effective demand, so that the wishes of only the wealthiest customers would be taken into account. This has been replaced by the concept of "need" together with consideration of the effects on non-users (noise, pollution, disruption and so on) of any project. In addition, bearing in mind the fact that returns in the future must be discounted back to the present to calculate their present value, investment along purely commercial lines will tend to concentrate on projects with short-term returns rather than on projects with benefits which occur over longer periods of time. As a result, the concept of cost-benefit analysis (CBA) has been devised. According to Prest and Turvey (1965):

> "CBA is a practical way of assessing the desirability of projects where it is important to take a long view (in the sense of looking at repercussions in the further as well as the nearer future) and a wide view (in the sense of allowing for side-effects of many kinds on many persons, industries, regions, etc.) - i.e. it implies the enumeration and evaluation of all relevant costs and benefits."

Using CBA, a project can be evaluated according to all the costs and benefits, whatever these may be. For example, the construction of a bypass road would entail costs to the investor (i.e. local or central government) but other groups would also incur costs, such as disruption during construction, noise, environmental intrusion, air pollution, nuisance and loss of property values. While there may be no tangible benefits to the investor (unless a toll were charged), benefits would accrue to other groups. Reduction in congestion on other roads, time savings for motorists and creation of jobs would be some obvious benefits. Thus, an evaluation using CBA would involve replacing or supplementing the purely commercial costs and returns with estimates of all the costs and benefits to all groups (investors, users and non-users) expressed in monetary values over time. These would then be fed into a calculation which would enable future benefits to be expressed in current prices and also discounted back to the present. The Net Present Value (NPV) of a project is thus expressed as the sum of all the benefits, discounted over time, less the sum of all the costs, also discounted over time. If the resultant NPV is greater than zero, the benefits outweigh the costs and the project should be undertaken, while if the NPV is less than zero, i.e. a negative value, the costs outweigh the benefits and the project should not proceed. In a case where the NPV is exactly zero, the executing agency will be indifferent between undertaking the project and not doing so. Pearce and Nash (1981) point out that, since calculation of NPV enables a single-value estimate of the project in question to be made irrespective of the way costs and benefits are distributed over time, this technique can be used in three ways:

i) To decide between acceptance and rejection of a project. As described above, the project will be accepted if NPV is greater than zero but will be rejected if NPV is less than zero;

ii) To list various alternatives in order of preference. A rank order can be drawn up so that the project with the highest NPV is given highest priority and that with the lowest (but still positive) NPV is given the lowest priority;

iii) To decide which of two or more mutually exclusive projects should be undertaken. In this situation, the project with the highest NPV will be chosen and the others discarded.

In the first of these three ways of undertaking investment appraisal (i.e. a decision between acceptance and rejection of a single project) the technique can be refined beyond a calculation of whether the NPV is greater or less than zero. The simple example given at the beginning of this Section was that, for income in future to be preferable to income now, £107 at current prices had to be offered in a year's time as an alternative to £100 now. Thus, a rate of return of 7% per annum has to be offered in order to make investment worthwhile. Consequently, a particular rate of return can be set as a bench-mark so that any project offering a lesser rate of return will be rejected and any project with a rate of return equal to or greater than the predetermined level will be accepted. This also allows a retrospetive appraisal to be undertaken of a project which has already been completed. In this case, the past costs and benefits, together with the predicted future levels of these, can be fed into calculations of the NPV and the annual rate of return to enable a judgment to be made of whether or not the investment was prudent.

A further possible use of investment appraisal technique is to carry out the process, as it were, in reverse. If the costs and the expected life (i.e. the number of years over which benefits will accrue) of the project are known, together with a predetermined rate of return as a bench-mark for evaluation, then a calculation can be made of the annual level of returns which would have to occur for the investment to be worthwhile. In this case, the aim is simply to compare the likely benefits stream with that calculated to be necessary in order for the investment to be justifiable.

This process of calculating NPV and annual rates of return has much to commend it since, in theory, every investment project would be submitted to a cost-benefit analysis so that the agency responsible for the project could decide whether or not to proceed. Ideally, these calculations would be made before work started but failing that, a retrospective analysis would at least enable mistakes to be avoided in future. Despite the obvious attractions of CBA, there are, nevertheless, a number of possible imperfections. Perhaps the most obvious of these is the danger of bias. Even the most altruistic and far-sighted individuals and organisations will tend to give greater weight to factors which affect them rather than other groups and to items of short-term rather than of long-term interest. Political considerations are often all too dominant in decisions concerning "public" investment and bias can only be eliminated by an open-minded approach and a concern for an accurate result.

The second major source of potential error arises from the difficulty of quantifying intangible items such as noise, air pollution or environmental intrusion. There is a danger of over-emphasising more easily quantified factors even though these might be outweighed by other considerations which, although perhaps more significant, are less easily expressed in purely monetary terms. One solution to this was offered by Lichfield (1956) who propounded the idea of a "Planning Balance Sheet" in which costs and benefits were listed separately and, instead of being given monetary values, were ranked on an ordinal scale. This did at least allow all the intangible items to be expressed, however inaccurately, so that a socio-economic account could be drawn up, listing the effects on different groups of different courses of action. By its very nature, however, Lichfield's approach cannot give a very accurate result and the ranking process is just as susceptible to bias as any quantification of factors.

Despite these limitations, cost-benefit analysis, when properly undertaken, does enable a quantification to be made of all the likely effects of a project so that its worth can be calculated on the basis of NPV and a rate of return. It is more correct to speak of a social cost-benefit analysis, since the intention is to include all the costs and benefits to society rather than to any one person or group. The actual steps involved in undertaking such an analysis are described in the next Section, together with the actual calculations in relation to the facilities for disabled people on Metro.

## 6.2 Steps involved in evaluating the facilities for disabled people on Metro

Two initial assumptions should be made before considering the necessary stages in evaluating the facilities for disabled people on Metro. The first is that only the facilities for disabled people, and not the whole system, need be evaluated in this thesis. An evaluation of Metro as a whole has been made in the report published by Tyne and Wear PTE (1986) and in any case the original remit of this thesis (see Chapter 1) was to study these facilities only, irrespective of any appraisal of the system as a whole. The second assumption is that the facilities are to be regarded as indivisible. In other words, no economic evaluation of individual facilities will be made, largely on the grounds that they should be regarded as one entity - for example, it would be difficult to envisage ramp and lift provision without wide barriers as well. Similarly, the facilities for the whole system rather than those at individual stations will be evaluated. It might be possible to assess the facilities at, say, the most heavily-used stations and assume no such provision elsewhere. Indeed, Chapter 2 shows that, when access for disabled people to the planned Metro system was originally being discussed, the intention at one stage was to provide facilities only at major stations or where a particular need could be proven. However, the policy which eventually evolved, albeit in a haphazard fashion, was for facilities to be provided at all stations. Consequently, it is appropriate to consider the facilities at all stations together. In any case, it would be difficult to predict the effects on disabled ridership if the facilities at, for example, some of the smaller stations had not been provided. However, some analysis of, for example, the relative cost-effectiveness of ramps as opposed to lifts, is given at the end of the Section.

As regards the actual process of carrying out the appraisal, Gwilliam and Mackie (1975) outline the five necessary steps:

i) Formulation of the alternatives for appraisal;

ii) Identification of the elements of benefit and cost;

iii) Forecasting these elements;

iv) Evaluation of these elements;

v) Interpretation of results.

In the case of evaluating the facilities for disabled people on Metro, step (i), the formulation of alternatives, is largely redundant since the course of action has already been decided upon. However, in a retrospective analysis such as this, a predetermined rate of return can be chosen as a bench-mark against which the project's own rate of return can be measured. A comparison of the rate of return of the facilities for disabled people on Metro with some appropriate rate is more useful than postulating all the possible alternatives to providing such facilities and then comparing them, since the decision has already been taken. However, a description and evaluation of the main alternative forms of transport for disabled people will be given in Section 3 of this Chapter.

Steps (ii) and (iii), the identification and forecasting of the elements of benefit and cost, are crucial: if any such elements are overlooked, then all the calculations will be based on faulty assumptions. The costs of the facilities for disabled people on Metro (not of the system as a whole) will be:

i) Capital and operating costs;

ii) Costs of environmental impact - disruption, pollution etc;

iii) Costs to other (i.e. able-bodied) Metro users, Some of these areas of cost can be discarded as having little significance, although an item should not be passed over simply because it is difficult to quantify. However, it is fairly certain that the additional environmental cost of the facilities will be almost nil as they cause no additional noise or air pollution and minimal visual intrusion. The only exception might be the ramped footbridges at some stations which could be regarded as unslightly but any impact thereof will not be great. Costs to other Metro users will occur through inconvenience and delays. Inconvenience would result from instances where, in order to provide access for disabled people, a more circuitous route to or within stations was involved. Since, in all instances, a more direct route for able-bodied people has been installed or retained, there can be little possibility of inconvenience arising in this way. Delays might occur through prolonged train dwell times at station while disabled people board or alight. This is also likely to have only minimal significance, however, due to the small number of severely disabled people using Metro.

Thus, the only significant costs are capital and operating costs. According to Tyne and Wear PTE (1986), the facilities for disabled people on Metro cost £4 million at November, 1975 prices, or £7 million at out-turn prices. It would be difficult to express out-turn prices in present (1986) terms since this would involve trying to identify the times at which individual items of expenditure were made. It is much simpler to take the November, 1975 cost of £4 million and update this to 1986 prices using the annual rates of inflation in the intervening years, based on the general index of retail prices as given by the Central Statistical Office (1986). This suggests that the capital cost of the facilities for disabled people on Metro was slightly over

£11 million at 1986 prices.

Identification and quantification of operating and maintenance costs is more difficult. All maintenance on Metro is carried out under a single contract so that the additional cost of maintaining the facilities for disabled people cannot easily be separated from other maintenance and operating costs. In addition, the maintenance costs of some items such as ramps, will be quite low, while other items such as lifts will be more expensive to maintain. Discussions with lift manufacturers suggest that, over a 20 to 30 year period, the maintenance costs of lifts such as those used on Metro are likely to be about 5% to 10% per annum of capital costs. Of all the facilities for disabled people on Metro, the lifts will probably have the highest maintenance costs so it is very unlikely that the annual operating and maintenance costs of all the facilities will be greater than 10% per annum of capital costs. Two sets of calculations will therefore be made: one based on the assumption that operating costs are 10% per annum of capital costs and another based on the assumption that they are 5%.

As regards the benefits of the facilities on Metro, several recent works have sought to identify the benefits accruing from disabled-accessible transport in general, and all have concluded that many such benefits are cross-sectoral i.e. benefits accrue to one organisation or group while costs are borne by another. A report by the European Conference of Ministers of Transport (1987) emphasised the problems with cross-sector benefits. Difficulties arise because each sector is usually concerned with reducing its own expenditure without considering the effects elsewhere. Gillingwater (1986) quotes an example of a reduction in local authority subsidies to public transport which resulted in increased expenditure by the education and social services departments of the same local authority, who were forced to provide special transport for their clients when public transport services were curtailed.

Bailey and Appleby (1986) and Oxley (1986) also describe the kind of cross-sector benefits likely to accrue from improved provision of transport for disabled people. As a result, the benefits accruing from the facilities for disabled people on Metro can be categorised as follows:

i) Revenue to the operator;

ii) Benefits to disabled Metro users;

iii) Benefits to other Metro passengers using these facilities;

iv) Benefits to all Metro users;

v) Benefits to other individuals in the private sector;

vi) Cross-sector benefits to other organisations in the public sector;

vii) Distributional benefits to society.

Unlike the list of possible costs discussed earlier in this Section, none of these areas of benefit can readily be discarded as insignificant. The only item to which this might apply would be increased revenue to the operator. Most disabled people are likely to be travelling on a Concessionary Travel Permit so that any trip generation will not yield increased revenue. Although a number of disabled Metro users are likely to be accompanied, any such escorts will probably also be elderly and travelling on a Permit so that little revenue will be generated in this way. However, it should be remembered that the surveys in Chapter 4 indicated that other groups of passengers also use the facilities on Metro "for disabled people", for example, those with prams and pushchairs. Such individuals will be eligible for a wide barrier pass but would still have to purchase tickets for their journeys. Any extra trips generated from this source would yield extra revenue.

All the other areas of benefit, i.e. items (ii) to (vii) above, will be cross-sectoral in nature. The authorities cited in the preceding paragraphs indicate the ways in which they are likely to occur. Disabled Metro users will benefit firstly by being able to make existing trips more cheaply or easily (i.e. redistributed trips); secondly by being able to make trips which were hitherto not undertaken (i.e. generated trips) and thirdly through deriving enjoyment and satisfaction from both redistributed and generated trips and the resultant increase in mobility and independence. Non-disabled Metro passengers who use the facilities will also benefit in these three ways. For example, someone with a pram or pushchair would be able to take it on Metro and thus avoid less satisfactory alternatives, such as reduced mobility or leaving the child at home and having to employ a childminder.

Able-bodied Metro users will also benefit, as mentioned in point (iv) above, in that items such as steps and handrails were designed to facilitate use by disabled people but as a result will be more amenable to all individuals. Item (v) referred to other individuals in the private sector. This category mainly comprises friends and relatives who care for disabled people. Such carers often experience considerable stress and frustration, which would be eased if the disabled person were able to venture out alone, or if accompanied trips were less of an ordeal or expense.

Cross-sector benefits to other organisations in the public sector were mentioned in item (vi) above. They are likely to be wide-ranging, provided that accessible public transport does result in a significant improvement in the mobility of disabled people. Potential sources include: a reduction in the need for less cost-effective specialised transport as more disabled people use public transport; savings in statutory resources as disabled people are able to visit doctors etc. rather than requiring to be visited at home and a reduced need for some welfare services such as a home help to do shopping. Ultimately, greater mobility may mean that disabled people could avoid becoming so dependent as to require very expensive institutional care. In addition, younger disabled people may be able to obtain (or stay in) employment and thus earn wages and pay taxes rather than require welfare benefit payments. Overall, if disabled people are able to derive pleasure from increased mobility, their general state of health might improve, thus lessening the need for medical care.

Finally, item (vii) raised the question of distributional benefits. Society will, in general, benefit from greater equality of opportunity which will result from, for example, improved transport for disabled people.

A warning note was sounded during the above discussion of cross-sector benefits, regarding the extent to which disabled people do enjoy greater mobility. It was stated in Chapter 4 that only a minority of disabled people in the Tyne and Wear area actually used Metro, while both Bailey and Appleby (1986) and Oxley (1986) point out that many specialised transport services are only used by a minority of the people for whom they are provided (specialised transport is studied in more detail in Section 3 of this Chapter).

Consequently, there is little evidence of substantial effects on health and social service budgets through cross-sector benefits of the kind described above. However, if more disabled people do use accessible transport then benefits will increase.

The likely benefits of the facilities for disabled people on Metro are thus fairly easy to identify. It is much more difficult to forecast and quantify their likely pattern over time. However, it is possible to calculate the total value of benefits which would have to accrue over a given number of years in order for the Net Present Value of the facilities for disabled people to be positive, given a suitable discount rate. In addition, since estimates of the total number of disabled Metro users per week in 1984 are available, a calculation could be made of the necessary value of benefits which would have to accrue per trip for the investment in these facilities to be worthwhile. Further calculations of this kind can then be made, taking into account all the users (not only disabled people) of these facilities. Any such calculations made at present (1986) will have to include allowance for the fact that, as well as discounting future benefits back to the present, past benefits will also have to be expressed in current prices since some sections of Metro have been open since 1980. The steps involved will be:

i) Decide upon the number of years over which the benefits will be discounted;

ii) Decide whether to carry out calculations on the basis of all disabled Metro users or on the basis of all users of the facilities for disabled people;

iii) Decide whether to assume that the number of passengers using the facilities will remain constant or will change, and if the latter is assumed then the extent of any change must also be calculated;

iv) Decide upon an annual discount rate;

v) Calculate the total value of benefits which would have to accrue to make the investment in the facilities for disabled people worthwhile;

vi) Calculate, on the basis of steps (i) to (v) above, the average benefits which would have to accrue per trip in order to justify investment.

It is probably prudent to make the same calculations for different sets of assumptions. As regards the number of years over which to discount benefits, a period of 30 years seems appropriate, since Tyne and Wear PTE (1986) gave this as the expected life of the system in their general economic evaluation.

Estimates of the total annual numbers of disabled people using Metro and of all Metro passengers using the facilities for disabled people are given in Section 2 of Chapter 4. It was calculated that in 1984/85, between 203,000 and 292,000 disabled people used Metro per year, while the total annual number of all Metro passengers using the facilities for disabled people in the same period was between 1.2 million and 1.8 million. In order to avoid the possibility of over-estimation due to errors in surveys or in factoring up, only the lower estimate in each case will be used, i.e. 203,000 disabled Metro users and 1.2 million passengers of all categories using the facilities for disabled people. Calculations will be made both on the basis of disabled users only and also on the basis of all users of the facilities, whether disabled or not.

As regards the other assumptions, different figures will be used in order to test alternative possibilities and to establish the robustness of the eventual conclusions. The question of whether to assume static or changing use of the facilities is complicated by the fact that this may be affected by two factors. Firstly, any increase in overall system ridership would result in greater usage of the facilities and secondly, it is also possible that the number of passengers using the facilities will rise independently of any change in overall system ridership. In the latter case, increased usage could result either from existing passengers making more trips or from new users. It is likely that the numbers of new users will increase as the incidence of disability in an ageing population will also rise but it is not easy to estimate the relative importance of either increased patronage from existing passengers or new users travelling on the system.

Predictions regarding future overall system ridership are again complicated by the deregulation of local bus services following the 1985 Transport Act. This may have led to a fall in ridership of about 10% in the year following deregulation but future increases in ridership may eventually compensate for this loss. Consequently, it will firstly be assumed that overall Metro ridership remains static at 1984/85 levels. Secondly, it will be taken that ridership (and thus use of the facilities) will increase by 5% in each successive year after 1984/85 and will fall by 5% in each preceding year before 1984/85. This rate of 5% is the annual rate of increase as given by Tyne and Wear PTE (1987) in ridership on the British Rail Newcastle - Sunderland service, the rail service most comparable to Metro, and is adopted here in the absence of any similar predictions regarding future Metro ridership. The only exception to this rate of increase will be the year 1987, when a 10% fall will be assumed, compared to 1986, as a result of bus deregulation.

As regards any extra generated use of the facilities in addition to overall ridership changes, the pessimistic assumption is again that no increase will occur. An alternative assumption would be an increase of 5% per annum for each successive year after 1986 and a 5% fall in each preceding year beforehand.

Two different discount rates will also be used. Firstly, the rate of 7% per annum as used by the Department of Transport for the evaluation of transport capital projects and secondly, a rate of 5%. The latter rate is the more optimistic but in either case with a 30 year expected life, any costs and benefits in years thereafter will have only small present values.

All future costs and benefits will be discounted back to the base year of 1986 and past benefits will be discounted forwards. Eight different calculations will be made as follows:

i) Take discount rate of 7%, use disabled Metro passengers only and assume no change in overall system ridership or generated use of the facilities;

ii) As (i) above but include all users of the facilities for disabled people;

iii) As (i) above but assume overall system ridership for each preceding year before 1986 falls by 5% and after a 10% decrease in 1987, rises by 5% in each successive year thereafter;

iv) As (iii) above but include all users of the facilities for disabled people;

v) Take discount rate of 5%, use disabled Metro passengers only and assume no change in overall system ridership or generated use of the facilities;

vi) As (v) above but include all users of the facilities for disabled people;

vii) As (v) above but assume overall system ridership for each preceding year before 1986 falls by 5% and after a 10% decrease in 1987, rises by 5% in each successive year thereafter. Generated use of the facilities results in an additional fall of 5% per annum in usage before 1986 and an increase of 5% per annum thereafter;

viii) As (vii) above but include all users of the facilities for disabled people.

In each case, a constant benefit per trip is assumed. If the value of this benefit per trip was known, then the following steps could be followed:

i) Multiply each year's ridership by benefit per trip and discount back to the base year of 1986;

ii) Add up each year's total benefits, as arrived at in step (i) above, to give Net Present Benefit of the facilities for disabled people;

iii) Calculate the Net Present Cost by adding the sum of each year's operating and maintenance costs (discounted at the same rate as benefits) to the total capital cost;

iv) If the Net Present Benefit arrived at in step (ii) exceeds the Net Present Cost arrived at in step (iii), then the investment in the facilities for disabled people is justified. If the Net Present Cost exceeds the Net Present Benefit, the investment is not justified.

Since, however, the benefit per trip is not known but assumed to be constant, the aim is to calculate the level of benefit per trip necessary to make the investment worthwhile. The steps involved are as follows:

i) Instead of multiplying each year's usage by benefit per trip, and then discounting back, each year's ridership *is discounted* to give the "effective" usage for that year. This is arrived at by taking the previous or subsequent year's ridership as a base, and adding or subtracting, as appropriate, the discounted element of ridership. If benefit per trip remains constant, the effect will be the same and this calculation can be made for each of the eight different assumptions of usage listed earlier in this Section;

ii) Add up each year's "effective" usage as arrived at in step (i) above, to give a total "effective" usage over 30 years;

iii) Calculate the Net Present Cost in the same way as step (iii) in the previous calculation, i.e. add the sum of each year's operating and maintenance costs (when discounted) to the total capital cost;

iv) Divide Net Present Cost, as arrived at in step (iii), by total "effective" usage, as arrived at in step (ii), to give the average benefit per trip necessary for the investment to be justified.

In most cases of this kind, where benefits accrue over time, the benefit per trip would be known and discounting would therefore be applied to each year's benefits. However, as mentioned before, the value of benefits per trip remains unknown so that a relatively new idea, of discounting ridership, has to be used. The calculations of "effective" use over 30 years, using each of the eight different assumptions listed above are given below under successive sub-headings:

1) Take discount rate of 7%, include disabled users only, and assume no change in usage over time

Total capital and operating costs are £32,380,207 as given in

Figure 6.1. Each year's usage must be discounted by 7% to give a total "effective" usage of 3,945,621 over 30 years as shown in Figure 6.2. The total benefits which would have to accrue per trip for the investment to be worthwhile are:

$$\frac{£32,380,207}{3,945,621} = £8.21 \text{ at 1986 prices}$$

2) Take discount rate of 7%, include all users of the facilities, and assume no change in usage over time

Total capital and operating costs are £32,380,207 as given in Figure 6.1. Each year's usage must be discounted by 7% to give a total "effective" usage of 23,323,862 over 30 years as shown in Figure 6.3. The total benefits which would have to accrue per trip for the investment to be worthwhile are:

$$\frac{£32,380,207}{23,323,862} = £1.39 \text{ at 1986 prices}$$

3) Take discount rate of 7%, include disabled users only, and assume usage changes over time in line with overall system ridership

Total capital and operating costs are £32,380,207 as given in Figure 6.1. Each year's usage must be discounted by 7% but is also assumed to change over time with a decrease of 5% per annum in each preceding year before 1986, a decrease of 10% in 1987 as compared to 1986 and an increase of 5% in each successive year thereafter. The net effect of discounting and usage changes is as follows:

i) Usage in each preceding year before 1986 is increased by 2% per annum;

ii) Usage in 1987 is reduced by 17% compared to 1986;

iii) Usage in each successive year after 1987 is reduced by 2% per annum.

Total "effective" usage is 4,640,148 as shown in Figure 6.4.

The total benefits which would have to accrue per trip for the investment to be worthwhile are:

$$\frac{£32,380,207}{4,640,148} = £6.98 \text{ at 1986 prices}$$

4) <u>Take discount rate of 7%, include all users of the facilities, and assume usage changes over time in line with overall system ridership</u>

Total capital and operating costs are £32,380,207 as given in Figure 6.1. Each year's usage must be discounted by 7% but it is also assumed to change over time with a decrease of 5% per annum in each preceding year before 1986, a decrease of 10% in 1987 as compared to 1986 and an increase of 5% in each successive year thereafter. The net effect of discounting and usage changes is as follows:

i) Usage in each preceding year before 1986 is increased by 2% per annum;

ii) Usage in 1987 is reduced by 17% compared to 1986;

iii) Usage in each successive year after 1987 is reduced by 2% per annum.

Total "effective" usage is 27,429,444 as shown in Figure 6.5. The total benefits which would have to accrue per trip for the investment to be worthwhile are:

$$\frac{£32,380,207}{27,429,444} = £1.18 \text{ at 1986 prices}$$

5) <u>Take discount rate of 5%, include disabled users only, and assume no change in usage over time</u>

Total capital and operating costs are £22,716,224 as given in Figure 6.6. Each year's usage must be discounted by 5% to give a total "effective" usage of 4,324,352 over 30 years as shown in Figure 6.7. The total benefits which would have to accrue per trip for the investment to be worthwhile are:

$$\frac{£22,716,224}{4,324,352} = £5.25 \text{ at 1986 prices}$$

6) Take discount rate of 5%, include all users of the facilities, and assume no change in usage over time

Total capital and operating costs are £22,716,224 as given in Figure 6.6. Each year's usage must be discounted by 5% to give a total "effective" usage of 25,562,673 over 30 years as shown in Figure 6.8. The total benefits which would have to accrue per trip for the investment to be worthwhile are:

$$\frac{£22,716,224}{25,562,673} = £0.89 \text{ at 1986 prices}$$

7) Take discount rate of 5%, include disabled users only, and assume usage changes over time, due both to overall system ridership changes and additional generated use of the facilities

Total capital and operating costs are £22,716,224 as given in Figure 6.6. Each year's usage must be discounted by 5% but it is also assumed to change due both to overall system ridership changes and to additional generated use of the facilities. Overall ridership changes are assumed to comprise a decrease of 5% per annum in each preceding year before 1986, a decrease of 10% in 1987 as compared to 1986 and an increase of 5% in each successive year thereafter. Additional generated use of the facilities is assumed to comprise a further decrease of 5% per annum in each preceding year before 1986 and an increase of 5% in each successive year after 1986. The net effect of discounting and usage changes is as follows:

i) Usage in each preceding year before 1986 is reduced by 5% per annum;

ii) Usage in 1987 is reduced by 10% compared to 1986;

iii) Usage in each successive year after 1987 is increased by 5% per annum.

Total "effective" usage is 8,794,099 as shown in Figure 6.9. The total benefits which would have to accrue per trip for the investment to be worthwhile are:

$$\frac{£22,716,224}{8,794,099} = £2.58 \text{ at 1986 prices}$$

8) Take discount rate of 5%, include all users of the facilities, and assume usage changes over time, due both to overall system ridership changes and additional generated use of the facilities

Total capital and operating costs are £22,716,224 as given in Figure 6.6. Each year's usage must be discounted by 5% but it is also assumed to change due both to overall system ridership changes and to additional generated use of the facilities. Overall ridership changes are assumed to comprise a decrease of 5% per annum in each preceding year before 1986, a decrease of 10% in 1987 as compared to 1986 and an increase of 5% in each successive year thereafter. Additional generated use of the facilities is assumed to comprise a further decrease of 5% per annum in each preceding year before 1986 and an increase of 5% in each successive year after 1986. The net effect of discounting and usage changes is as follows:

i) Usage in each preceding year before 1986 is reduced by 5% per annum;

ii) Usage in 1987 is reduced by 10% compared to 1986;

iii) Usage in each successive year after 1987 is increased by 5% per annum.

Total "effective" usage is 51,984,819 as shown in Figure 6.10. The total benefits which would have to accrue per trip for the investment to be worthwhile are:

$$\frac{£22,716,224}{51,984,819} = £0.44 \text{ at 1986 prices}$$

From these eight different calculations, the estimated total benefit which must accrue for the investment in facilities for disabled people to have been worthwhile vary between £8.21 and £0.44 per trip at 1986 prices and it must be admitted that this variation is quite considerable. The benefits needed per trip are lower, firstly, if all users of the facilities are taken into account rather than disabled users only, secondly, if usage is assumed to change over time rather than remain static, thirdly, if a discount rate of 5% is assumed rather than 7%, and fourthly, if operating costs are taken to be 5% per annum of capital costs rather than 10%. As stated previously, the aim of including so many alternative sets of assumptions was to test the various possibilities and to establish the robustness of the eventual conclusions.

As regards the question of whether to base usage upon disabled people only or upon all users of these facilities, there is the inescapable fact that the facilities "for disabled people" are of benefit to other groups. It could be argued that these facilities were originally intended for disabled people only and that they should be evaluated solely on the basis of their use by such individuals. However, evidence in Section 4 of Chapter 2 shows that the PTE realised that the facilities for disabled people would be of use to others, notably people with prams and pushchairs, so that the inclusion of this group of people in the evaluation can be justified on these grounds alone. Moreover, some disabilities, such as heart trouble, may not be apparent to an observer carrying out a survey but would still constitute legitimate grounds for preferring lifts to stairs or escalators. Nevertheless, there is still an element of "windfall" benefit arising from the use of the facilities by people outside the target groups for which the facilities were intended.

For the time being, therefore, results based on both disabled people only and on all users of the facilities will be retained for use. Similarly, results based on both usage remaining static and on usage changing over time will be kept. The question which must now be asked is whether it is likely that these levels of benefit will accrue on each occasion of a Metro trip which involves the use of one or more of the facilities for disabled people. Possible sources of benefit and the ways in which these would be likely to occur were identified earlier in this Section. Bearing these in mind, it does seem likely that, if all the users of these facilities are taken into account, between £0.44 and £1.39 worth of benefits will accrue from each Metro trip involving the use of facilities for disabled people. If, however, disabled users only are taken into account, benefits of £2.58 to £8.21 per trip seem less likely but still possible, as will be discussed more fully in Section 4 of this Chapter. Therefore, it appears that the investment in facilities for disabled people on Metro can be justified, but this justification relies heavily on "windfall" benefits arising from usage by people outside the original target groups.

The figures given above do not represent the cost per trip of the facilities for disabled people. Section 3 of this Chapter contains a comparison of the cost-effectiveness of various alternative forms of transport for disabled people and all the sources cited in that Section measure cost-effectiveness in terms of cost per trip. However, for the investment in each of these alternatives to have been worthwhile, sufficient benefits would have to be generated to at least offset costs. Consequently, a cost per trip can be taken as an indication of the average benefits which would have to be generated per trip for the investment to have been worthwhile. Comparisons can therefore be made, but with the proviso that the sources cited in the next Section may not have included in their calculations all likely future costs and benefits, or have discounted them in the same way. Many of the alternative forms of transport for disabled people examined in the next Section are likely to have higher operating costs in relation to capital costs than Metro, so that a failure to take future costs into account will result in an under-estimate of cost per trip. With this caveat, however, some comparisons can be made.

## 6.3 Alternative forms of transport for disabled people: an appraisal

According to Chapter 5, the main reasons why many disabled people do not use Metro appear to be associated with general mobility problems rather than with specific difficulties with the system itself. Given that Metro is intended to provide rapid transport along major traffic corridors, it is inevitable that residential districts may be some distance from a Metro station. While a journey of a few hundred yards will pose little difficulty to able-bodied people or car users, many disabled persons with low mobility and low car ownership might not be able to manage such a journey. Consequently, it could be argued that the facilities for disabled people on Metro will be irrelevant to individuals who are unable to reach their nearest Metro station, so that some other form of transport provision, which would give a more personalised door-to-door service, is more appropriate.

Over the past 15 to 20 years, a wide variety of transport services designed to meet the particular needs of elderly and disabled people have sprung up in the UK and abroad, especially in the USA. A lengthy description of the many different types of specialised provision which are available is outside the scope of this thesis, but Bailey and Layzell (1983) give a good analysis of the current situation in the UK. The various kinds of services which they describe, together with other schemes, can be categorised as follows:

i) Services provided as an adjunct to some other activity or which are available only to a particular group of people. Many agencies which seek to help disabled people have found it necessary to transport their clients to and from the facilities and activities provided for them. These include: hospital out-patient clinics, day centres, lunch clubs, training centres and special schools. In addition, a number of organisations exist solely or mainly to provide transport on a group basis for elderly or disabled people, or other individuals with special needs. Consideration of such services is outside the scope of this thesis since they are not really an alternative to the facilities for disabled people on Metro. The aim of the latter is to provide increased mobility opportunities for all disabled people irrespective of journey purpose, while the services described in this category are available either only on a restricted basis to particular groups or to people participating in a certain activity;

ii) Specialised services which are intended to meet the general mobility needs of disabled people by providing demand-responsive, door-to-door transport on an individual basis. Such services really began in the USA and now operate in many Western countries including the UK. Typically, a fleet of minibuses equipped with wheelchair lifts will be used to take elderly and disabled people on any desired journey within a particular area. Operating practices vary between schemes, but potential clients are usually referred by welfare or health services and, once registered with the scheme, can make bookings either on a regular basis or for individual trips by telephone, usually with 24 or 48 hours' notice. Some schemes provide transport free of charge while others make a nominal charge. Funding usually comes from local or central government or from charitable organisations. Many such services have grown out of schemes to provide transport for disabled people in connection with a particular activity, i.e. services described in category (i) above and in some cases the distinction is rather blurred;

iii) Transport provided for disabled people which operates on fixed routes and predetermined schedules, akin to a conventional bus service. The unfavourable results of the American wheelchair-accessible bus programme which sought to equip all buses in public service with lifts or ramps to facilitate wheelchair access, has led to a number of UK operators providing only a small-scale service for disabled people. Typically, one or two vehicles in a fleet will be converted to accommodate wheelchairs and then operated on a route devised to cater for disabled people. Although a fixed schedule is generally operated, this will usually allow for longer boarding times. Reduced fares are often charged. The aim is to provide effective transport for disabled people without the expense and difficulty of making the entire fleet wheelchair-accessible.

The two categories which can be described as alternatives to the facilities for disabled people on Metro, i.e. categories (ii) and (iii), differ in one respect from Metro in that they provide transport for disabled people on a segregated basis. Much has been written about the "apartheid of disability" and Fielding (1982) among others has outlined the way in which American disabled rights campaigners sought to achieve "mainstreaming" through equal access to all transport facilities rather than accept equal mobility through schemes which separated disabled from able-bodied people. The aim in the USA in the 1960s and 1970s was to integrate disabled people into society so that "separate but equal" provision in transport, housing, education and other areas was denounced. Many of the arguments used to achieve greater racial equality were employed to promote policies of "mainstreaming" for disabled people in a political climate which was both sympathetic to equal rights and also aware of the lobbying power of elderly people and of Vietnam war veterans. Bearing in mind this controversy, it is appropriate to examine some of the advantages and disadvantages, both of "mainstreaming" and of specialised services.

Wallin (1982) evaluates specialised transport in comparison with "mainstream" services, by which he largely means the unsuccessful US wheelchair-accessible bus programme. Although his views are clouded by the failure of the latter, his initial analysis is sound. He points out that the main advantage of an accessible mainstream service is that disabled people can enjoy an expanded quality of service free of restrictions such as the need to pre-book which usually obtain with a specialised service. This will lead to an increase in the mobility of disabled people so that there may be a reduction in the demand for welfare services. Some disabled people might be able to find employment as a result of increased mobility, which would also reduce the overall demand for welfare support, but since most disabled people are elderly, any benefits in this respect would be marginal. Wallin also argues that once the capital cost of accessible mainstream services is met, the marginal cost per trip is lower than that of a specialised service. In addition, although the average cost of accessible public transport may be higher than for special transport, Wallin claims that most disabled people perceive the latter to be of lower quality than the former. There will also be what Wallin describes as benefits of conscience and equity from the provision of facilities for disabled people on conventional public transport. Such provision will enhance the lot of disabled people in the community as a whole and will help to create a more equitable society.

On the other hand, Wallin points out that a specialised service does provide door-to-door transport on an individual basis. An accessible public transport system would be of little use to those disabled people who cannot reach their nearest railway station or bus stop, so that special transport can provide higher overall mobility in this context. On the basis of unfavourable experiences in the USA with wheelchair-accessible buses on conventional services, Wallin concludes that "little justification can be found on conventional cost-benefit terms for fully accessible /public transport/ systems". However, many of the problems associated with the American wheelchair-accessible bus programme do not apply to the facilities for disabled people on Metro, so that Wallin's conclusions are not automatically valid in this case.

Given that accessible public transport and special services both have advantages, the best solution might seem to be the provision of both, so that individual disabled people could exercise their own personal preference. However, in view of probable financial constraints, the possibility of being able to sustain both a specialised service and facilities for disabled people on public transport is somewhat remote, especially since the likely demand will probably not be capable of sustaining the cost-effectiveness of both. A combination of the two could be and has been introduced in some instances - for example, the existing public transport system might be made accessible for ambulant disabled people and then supplemented by a special transport service for wheelchair users, but provision of both for all groups of disabled people would be a less viable proposition, so that a choice has to be made. Having noted the fact that accessible public transport and a specialised service differ in some respects, it is possible to examine the performance and cost-effectiveness of certain of these specialised services. A vast amount of literature, especially from the USA, is available concerning individual schemes but a number of overview studies have also been conducted. The results of these are summarised in Figure 6.11: performance is measured in terms of cost per trip, all of which are in pounds sterling at 1986 prices. The results show an enormous variation, despite the fact that all the services under consideration are demand-responsive, door-to-door minibus services providing transport for elderly and disabled people. Some of the authorities cited in the table offer possible reasons for the variation: services which cover rural areas with low population densities tend to have higher costs per trip than those operating in urban areas with higher population densities. In addition, the table shows that the highest costs per trip were those given in earlier studies which suggests that efficiency may have improved with experience and some of the sources quoted in the table describe differences in operating techniques which may be responsible for some of the variation in costs per trip.

One reservation which should be made is that it is not clear whether the calculations of cost per trip have been made on the basis of all likely costs and usage during the expected life of the scheme. In Section 2 of this Chapter, the facilities for disabled people on Metro were evaluated on the basis of all potential usage over the assumed life of the facilities, i.e. 30 years. If, in any calculations of cost per trip, insufficient allowance is made for ridership in the future, a falsely high figure for the cost per trip will result, so that some of the costs per trip given in Figure 6.11 may be inaccurate. However, as pointed out earlier, Wallin (1982) argues that facilities for disabled people on conventional public transport will have a relatively high average cost per trip and a lower marginal cost. In contrast, specialised transport will have a low average cost but a higher marginal cost. McKnight (1986) expands this point by emphasising the fact that specialised transport offers little opportunity for economies of scale. Increased ridership will therefore result in an almost proportionate increase in costs, so that although a special transport scheme may try to attract patronage, this will in the long term only bring financial and capacity problems. However, in the case of accessible public transport, with its high average cost and low marginal cost, increasing patronage will result in lower average costs per trip. Once facilities for disabled people are provided on public transport, their cost-effectiveness will improve as their use (whether by disabled or non-disabled people) increases.

It is also important to remember this point when making predictions as to future costs and ridership of various forms of transport for disabled people. A failure to take sufficient account of the future when calculating the cost per trip of a specialised service will result in costs as well as ridership being ignored, so that costs per trip may be under-estimated.

The fact remains that special services with costs per trip in 1986 prices of £5 are not unusual and the most recent figures for the UK, as given by Bailey (1984), suggest an average cost of £8 per trip. These figures are similar to the value of benefits needed per trip to justify the facilities for disabled people on Metro (i.e. about £2.60 to £8.20 as given in Section 2 of this Chapter), if calculations are based only on disabled users of these facilities. If all users are taken into account, the necessary benefits to justify the investment are in the region of £0.40 to £1.40, much lower than the costs per trip of specialised transport. On this basis, the facilities on Metro seem much more cost-effective than special services and, even if disabled users only are taken into account, they are at least comparable. Even so, the question remains of whether specialised transport is more physically effective in the sense of increasing the mobility of a greater number of disabled people. Evidence from Chapter 4 suggests that only a third of disabled people in the area served by Metro have actually used the system, so might a specialised transport service be able to reach a higher percentage of the disabled population? Most specialised transport schemes require would-be users to provide evidence of eligibility and to register with the service before bookings can be made. In most cases, an approximate estimate will be available of the size of the total eligible population in the area served by the scheme, so that the number of registrants can be compared with the total number of eligible individuals. In a survey of special schemes in the USA, the Transportation Research Board (1983) found that between 3% and 33% of the eligible population in areas served by such schemes had registered. Texieira (1978) investigated five American schemes and found that between 0.3% and 22% of eligible individuals were registered while another survey of three US schemes by Everett (1984) revealed percentages of 1%, 6% and 40%.

Bailey and Appleby (1986) investigated ten special schemes in the UK and found that less than half the people registered with such schemes used them in a four-week survey period. In contrast, 4% of registrants accounted for 32% of trips. Surveys of registrants indicated that at least half regarded their particular scheme as being potentially useful in an emergency, but in fact made very little use of it. This picture appears to parallel that which emerges from Metro, where only a minority of disabled people use the system and those who travel on it tend to do so only infrequently.

Possible reasons why eligible elderly and disabled people do not use specialised services are suggested by Lyons and Lipowitz (1982). They conclude that, in urban areas, less than 15% of elderly people (many of whom would be disabled) who "need" special services actually use them. The main factors are:

i) A significant minority of elderly people are able to travel by car and/or conventional public transport;

ii) Lack of knowledge about the availability of special transport appears to be commonplace even amongst eligible individuals. Inadequate publicity has often led to widespread ignorance of the existence of schemes or to an exaggerated perception of the likely restrictions upon eligibility and use of the service;

iii) Problems with the characteristics of specialised services also seem to deter use. The need to pre-book allied in some cases with delays can reduce the attractiveness of a scheme. In addition, a minority of eligible users may not register on the grounds that special transport schemes represent "charity", acceptance of which would involve loss of self-esteem.

These factors may not apply in the UK context, but a study of "Readibus", a demand-responsive special service in Reading, Berkshire, is of interest. According to Bowlby et al (1984), the main reasons for non-use of Readibus were: the availability of alternative transport (mainly cars); dissatisfaction with the pre-booking arrangements and, among the very elderly and/or severely disabled, an acceptance of poor mobility which may now be difficult to change.

While it must be admitted that most of the above evidence is based on experience in the USA, the indications are that specialised transport does not seem to be more effective than Metro in reaching the majority of disabled people and indeed it may well be less so. It therefore seems that the advantage of door-to-door service which specialised transport can offer is outweighed by disadvantages such as lack of knowledge among target groups and difficulties with the need to pre-book. Furthermore, it can be postulated that low usage of both the facilities for disabled people on Metro and of specialised transport is due to wider and perhaps more intractible problems arising from disability than from any particular shortcomings in either case. This hypothesis will be explored more fully later in this Chapter and also in Chapter 7.

The last of the three categories of transport for disabled people described at the beginning of this Chapter comprises the variety of bus services for disabled people which run on fixed routes and timetables, and are thus more akin to conventional public transport than are the demand-responsive schemes analysed above. A number of fixed-route services for disabled people have been started in the UK in recent years. In general, the aim has been to provide effective transport for disabled people, especially those in wheelchairs, by running a small number of modified vehicles on specially-planned routes, as an alternative to equipping most or all of the bus fleet with wheelchair lifts or ramps. Since this is, at least in part, a reaction to the unfavourable results of the American wheelchair-accessible bus programme, it is appropriate to analyse the events which led to the move away from the policy to provide wheelchair access on virtually all buses in the USA.

The history of the wheelchair-accessible bus programme has been well documented by Fielding (1982), Walther et al (1984) and other authorities. Increased awareness of the needs (and voting powers) of disabled people, partly due to intensive lobbying by wounded Vietnam war veterans, led in the late 1960s and early 1970s to a series of legislative measures aimed at integrating disabled people into society. The 1968 Architectural Barriers Act dealt mainly with access for disabled people to public buildings, but Congressional debates on this Act eventually included discussions regarding provision for disabled people on public transport. Disabled rights groups were encouraged by the successful passage of the Architectural Barriers Act to press for further legislation which would guarantee the right of access for disabled people to public transport. The Urban Mass Transportation Act of 1964 had previously enabled the Federal Government to give financial assistance to public transport projects and in 1970, an Amendment to this Act (the Biaggi Amendment) was passed. According to this Amendment, the right of "elderly and handicapped persons ... to utilise mass transportation facilities and services" was now declared to be national policy and "special efforts" should be made to ensure that all public transport was designed accordingly. Moreover, all Federal Government assistance to public transport henceforth incorporated this policy.

Concern that this Amendment would become a dead letter due to inadequate funding provoked further debate, culminating in 1973 in two pieces of legislation, the Federal Aid to Highways Act and the Rehabilitation Act. The first of these two Acts established that the Federal Government was obliged to pay the capital cost of facilities for disabled people on highways and public transport, while the latter Act included a clause adapted from civil rights legislation of the early 1960s. This clause, the oft-quoted Section 504, stated that:

"No otherwise qualified handicapped individual in the United States ... shall, solely by reason of his handicap, be excluded from ... any program or activity receiving Federal financial assistance."

The implications of Section 504 were not at first fully appreciated by the American public transport industry. At the same time, the main preoccupation of the industry was to increase the level of Federal financial assistance towards both capital and operating costs and access for disabled people was seen as a small price to pay in return for generally increased Federal funding. While public transport operators were beginning to realise the possible effects of Section 504, various Federal Government Departments issued a series of directives on ways of meeting the recent legislation. In April, 1976, the Department of Transportation produced a set of guidelines based on the Federal Aid to Highways Act of 1973 and also on the 1970 Biaggi Amendment to the Urban Mass Transportation Act of 1964. These guidelines suggested that public transport operators could meet legislative requirements either by providing specialised transport, using some of the Federal financial assistance which had been provided, or by making part (but not all) of their conventional bus fleets accessible. No guidelines regarding Section 504 were forthcoming until a year later when pressure from disabled rights campaigners forced the then Department of Health, Education and Welfare to issue interim regulations in May, 1977 for the implementation of Section 504.

Matters were then complicated by the introduction of wheelchair-accessible buses in normal service in San Diego, California and St Louis, Missouri in February and August, 1977 respectively, although the introduction of these buses was not connected to Section 504. Early experiences in both cases suggested that high costs and low utilisation rates would become permanent features of any wheelchair-accessible bus programme. At about the same time, the Department of Transportation issued the Transbus regulations which again were not directly connected with Section 504, but nevertheless consisted of a specification for disabled-accessible buses for conventional public transport services, although provision for wheelchair users was optional. However, the Transbus regulations were suspended and then withdrawn when it was found that no manufacturers were prepared to build buses to these specifications.

It was left to the Department of Health, Education and Welfare to produce (supposedly) final guidelines on Section 504 early in 1978. According to these guidelines, all programmes and activities in receipt of Federal Government funds had to be accessible to disabled people. The Department of Transportation followed this a year later by issuing regulations to the effect that all new buses should henceforth incorporate wheelchair access and at least 50% of all operators' peak-hour fleets had to be accessible within 10 years. If the latter was not possible, special transport had to be introduced as an interim measure, provided that service levels were comparable to those of the conventional bus network. However, as a result of a series of legal cases, the American Public Transport Association (APTA) obtained a ruling in 1981 that the Department of Transportation had exceeded its powers by insisting on wheelchair access, on the grounds that such insistence imposed an "undue" financial burden on bus operators. The election of President Reagan in 1980 led to a review of the existing Section 504 regulations. In the light of this review and of the outcome of the APTA's court cases, the Department of Transportation ruled that, while recipients of Federal assistance for transport projects should still make provision for disabled people, local communities should be left to decide upon the best means of making such provision. In other words, bus operators were no longer compelled to make any or all of their vehicles wheelchair-accessible, but could institute a specialised transport scheme instead. The original aim of the wheelchair-accessible bus programme had thus been completely overturned.

Quite simply, the failure of this programme and the resultant policy reversal by the Department of Transportation, was due to low usage, high costs and mechanical unreliability. The Transportation Research Board (1983) studied some 48 bus operators throughout the USA to establish usage and cost levels. Of the 48 operators, some were small concerns with only a few buses, all of which were lift-equipped, while others were major urban operators with fleets of up to 2,500 vehicles, of which 25% to 50% were lift-equipped. Most operators reported that, on average, there was less than one lift boarding per day per lift-equipped bus and when the figures for all the operators were taken together, the average was about 0.34 lift boardings per day per lift-equipped bus. One or two operators had achieved significantly higher usage, but these mainly tended to be smaller undertakings. In UK sterling at 1986 prices, the costs per lift boarding, i.e. per trip, varied between 10 pence and an extreme of over £1,200, but most operators reported costs per trip of between about £2 and £40. Comparison with the costs per trip of specialised transport schemes as given in Figure 6.11 suggests that the latter are generally more cost-effective. However, most specialised schemes cater for ambulant disabled people as well as wheelchair users, so that costs are spread over a larger user group. In contrast, most public transport operators using lift-equipped buses restricted use of the lift to wheelchair users only and ambulant disabled people had to use the conventional entrances and exits. This policy was dictated by the fact that lift boardings tended to increase dwell times at stops so that it was in the interests of operators to restrict the use of lifts as much as possible. Thus, although the wheelchair-accessible buses did incorporate additional features to assist other disabled people, the costs of the lift equipment were spread over a smaller number of people than would have been the case if ambulant disabled people had also been allowed to use the lifts. Such a policy would, however, have resulted in many more delays to services.

With costs per trip of £2 to £40, the American wheelchair-accessible bus programme is also less cost-effective than the facilities for disabled people on Metro. Calculations of the cost-effectiveness of the latter, as given in Section 2 of this Chapter, were based firstly on disabled users only and secondly on all users of these facilities. In the first case, the benefits needed per trip in order for the investment to be justified were between about £2.60 and £8.20 per trip. On this basis, the facilities on Metro are more cost-effective than most of the operators involved in the American wheelchair-accessible bus programme. However, if all users of the facilities on Metro are taken into account, the necessary benefits per trip fall to between about £0.40 and £1.40, which is below the cost per trip of all but the most efficient American wheelchair-accessible bus operators.

Furthermore, it was found that the wheelchair-accessible bus programme was only of benefit to a very small number of wheelchair users. As mentioned above, St Louis, Missouri was one of the first cities to introduce lift-equipped buses and the Transportation Research Board reported that, out of 1,026 lift boardings made during the first 11 months of accessible services, 92% were made by the same 40 people. Penetration of the wheelchair using community was thus extremely poor, as these 40 individuals represented about 2% of all the wheelchair users in St Louis in 1983 who lived within half a mile of a bus stop. Problems with lift reliability were also encountered, not all of which could be attributed to "teething troubles" with new equipment. An investigation was carried out by Booz, Allen and Hamilton Inc and Synenergy Consulting Services (1980) into early experiences with lift-equipped buses and included details of lift reliability. Operators were asked whether the advent of lift-equipped buses had necessitated an increase in the size of the vehicle "float", i.e. the number of buses kept as spares to cover for maintenance and breakdowns. Evidence suggested that, while a float of up to 20% was sufficient for buses without lifts, 40% to 50% of the lift-equipped fleet had to be kept as a float. In addition, the number of maintenance staff had had to be increased by up to 100%.

It is hardly surprising that bus operators in the UK have been reluctant to contemplate any measures involving the fitting of lifts to all or any of their vehicles in general service. However, a number of operators, beginning with Leicester City Transport in 1982, introduced services especially tailored to suit the needs of disabled people, particularly wheelchair users. A study of all the services then in operation was carried out by Oxley (1984). He reported that in early 1984, seven British operators had introduced bus services for disabled people operating on fixed routes, while several more undertakings were investigating the possibility of such services. In addition, at least 22 operators had wheelchair-accessible vehicles available for private hire.

The vehicles used on these services varied from minibuses and small coaches to full-size single and double-deck vehicles. Some buses had been specially ordered while others were older buses which had been modified: in virtually all cases, wheelchair access was effected via a lift but a few vehicles had ramps instead. As regards passenger capacity, the maximum number of wheelchairs which could be carried varied from two to 12 with between six and 31 seats for ambulant disabled passengers or people who did not wish to remain in their wheelchairs once inside the bus. Wheelchair restraint systems of various types were fitted in all cases while wheelchair stowage facilities were usually provided for people wishing to transfer to a seat.

The typical pattern of service provision followed that established by Leicester City Transport. In general, the intention was to use the adapted buses on a variety of specially devised routes with the aim of covering most parts of the operator's area at least once a week. Most routes were planned to serve hospitals, day centres and sheltered housing developments as well as town centres. Fares at concessionary rates were charged on most services.

Strathclyde PTE meanwhile attempted to provide a more comprehensive range of services for disabled people. In addition to four routes in West Glasgow operating on fixed routes and timetables of the kind described above, a number of demand-responsive minibus services were also introduced to act as feeders for the other services. Full-size wheelchair-accessible buses also operated additional journeys on three conventional routes.

Oxley points out (p.12 of his report) that the cost of providing and/or adapting vehicles varied considerably. Since wheelchair-accessible services tended to be less demanding upon vehicles than ordinary routes, several operators were able to use buses which would normally have been regarded as life-expired. South Yorkshire PTE estimated the cost of purchasing and converting second-hand single-deck buses to be about £9,300 each. In contrast, Leicester City Transport reported a cost of £39,000 per bus for new vehicles, of which about £5,000 was attributable to the lift and related equipment. Operating costs were generally somewhat higher than for standard services, since in most cases, an attendant was provided on vehicles.

Patronage in all cases rose steadily over time, apart from seasonal variations. In general, about half the number of passengers used the lift or ramp, although lift use was not usually confined to people in wheelchairs and the percentage of all passengers who used a wheelchair varied from about 20% to over 40%. If Oxley's calculations of costs are expressed in 1986 prices, the average cost per trip varied from about £2.20 to £3.30 for all passengers, or £3.30 to £6.10 if only wheelchair users were taken into account. Oxley points out (p.25) that increasing usage levels would probably lead to a reduction in average costs per trip. These costs compare very well with demand-responsive transport at £1.00 to £27 per trip (see Figure 6.11) and with the American wheelchair-accessible bus programme at £2.00 to £40 per trip for most operators. As regards the facilities for disabled people on Metro, it will be remembered that calculations were made of the benefits necessary per trip in order for the investment to be justified. These were either about £2.60 to £8.20 if disabled users only were included, or about £0.40 to £1.40 if all users of these facilities were taken into account. Thus, on the former basis, the facilities on Metro were less cost-effective than the services evaluated by Oxley, but on the latter basis, the facilities on Metro are more cost-effective.

A subsequent study of additional wheelchair-accessible bus services (which included some specialised door-to-door schemes), also by Oxley (1986), revealed once again that a minority of users tended to account for a relatively large percentage of trips. A comparison of those who actually used the services with the total numbers of disabled people in the areas served led Oxley to conclude that:

> "The majority of the people ... who could benefit from special bus services are not apparently making use of them."

So far in this Section, no mention has been made, except in passing, of Metro and rapid transit systems other than Tyne and Wear which incorporate facilities for disabled people. While it would have been very interesting to carry out a detailed comparison between some of these systems and the Tyne and Wear Metro, very little material is available so that the brief discussion below is regrettably little more than a postscript to this Section. Although some useful information has been made available, further efforts by the author to secure additional data from transport operators and other sources have met with little success. A number of recently-constructed Metro and rapid transit systems in various parts of the world have incorporated provision for disabled people, but details are available of only two of these, namely the Washington, D.C. Metro and the Bay Area Rapid Transit (BART) system in San Francisco, California. Both systems incorporate facilities for disabled people along the lines of those provided on the Tyne and Wear Metro, such as lifts, ramps and special ticket gates or barriers for wheelchairs.

The following information concerning BART has been provided through the courtesy of Bruce G Bauer, BART Transportation Planner. At present, the BART system comprises four lines with a total of 34 stations, linking the principal cities and towns in the San Francisco Bay area. Facilities for disabled people include: lifts; ramps; wheelchair-accessible ticket barriers; Braille markings; courtesy telephones for disabled people; wheelchair-accessible rest-rooms; reserved car parking spaces and level entry/exit from platforms to trains. Elderly and disabled people are eligible for concessionary fares at 10% of the standard rate. All stations are staffed and station agents will provide assistance to disabled travellers upon request. A lift usage count in late 1981 showed that about 3,500 passengers per week used lifts at BART stations (all of which are so equipped), of which about 30% were wheelchair users and the remaining 70% were other disabled people. According to Bushell and Stonham (1983), system ridership in 1981/82 was about 53.3 million per annum or approximately 1.03 million per week so that on this basis, about 0.3% of BART passengers used lifts and all of these lift users were disabled people. This figure is remarkably close to the estimate (see Section 2 of Chapter 4) that between 0.3% and 0.5% of passengers on the Tyne and Wear Metro are disabled and require one or more of the facilities provided for them. However, it would be unwise to attach too much significance to this similarity because of possible inaccuracies and differences in survey technique. Despite various requests, no indication of the approximate cost of the facilities for disabled people on BART were made available to the author, so that no attempt can be made to calculate costs per trip.

As regards the Washington Metro, which has four lines with a total of 44 stations linking Washington, D.C. with its environs, no details could be obtained of the cost of facilities for disabled people or of the numbers of people using them. Even so, an article by Coleman and Graye (1980) gives a description of the facilities and a brief assessment of their performance in relation to the criteria laid down by the American National Standards Institute (ANSI). These ANSI specifications cited by Coleman and Graye are probably an earlier edition than that used in Chapter 5 of this thesis. The list of facilities provided for disabled people on the Washington Metro is very similar to that for BART, except that not all stations have lift access, ramps being provided instead. As in the case of BART (but not the Tyne and Wear Metro), all stations are supposed to be staffed. A number of problems were identified by Coleman and Graye including the following:

i) Lifts were said to be difficult to locate, unreliable and dirty;

ii) On-train announcements were often garbled or omitted;

iii) The step and/or gap between platforms and train entrances sometimes caused problems, even though level access had been intended;

iv) Although all stations were supposed to be staffed throughout the operational day, many small stations were in fact left without staff at slack periods;

v) Ticket machines and barriers were said to be unreliable.

In addition, the ANSI guidelines were described as insufficient to meet the needs of disabled users of rapid transit systems. However, it is unfortunate that so little information could be obtained on the facilities for disabled people on other Metro and rapid transit systems, since costs per trip and other details would have enabled interesting comparisons to be made.

## 6.4 Conclusions

The aim of this Chapter so far has been to establish the cost-effectiveness of the facilities for disabled people on Metro, partly by conducting a cost-benefit analysis and partly by evaluating the cost-effectiveness of other forms of transport for disabled people. In Sections 1 and 2, the assumption was made that the facilities on Metro should not be evaluated according to strictly commercial criteria and it is appropriate to consider the reasons for this.

The facilities for disabled people on Metro were never expected to make a profit in the commercial sense, i.e., for revenue from passengers to cover costs and also provide a return on investment, and at present there is no prospect of this ever being the case. Passengers using such facilities are not expected to pay any additional fare for the privilege of doing so (although in the past a charge was made for wide barrier passes issued to non-disabled people and those living outside Tyne and Wear). In addition, most disabled Metro users are also eligible for a Concessionary Travel Permit which allows free off-peak travel, thus exempting them even from the fares which would normally be payable. It is not the purpose of this thesis to enter into a justification of the reasons for providing some goods and services on grounds other than commercial viability, but there is an acceptance in most societies of the need to base some investment decisions on alternative criteria. The techniques of social cost-benefit analysis described in Section 1 of this Chapter were developed to evaluate this kind of investment, in order to take into account all likely costs and benefits wherever they occur.

It might be argued that the value of benefits calculated in Section 2 of this Chapter as being necessary per trip in order to justify the investment in the facilities on Metro could be used to set a toll for their use, which could be levied in addition to normal fares. This investment would then be viable on purely commercial grounds. Moreover, it might be supposed that many of the users of these facilities would be prepared to pay this additional amount. However, as mentioned above, it has long been accepted in the UK and elsewhere that items which might loosely be described as welfare services are paid for by contributions from society as a whole, through rates, taxes and so on, rather than by charges levied solely upon users of such services. This policy is based on the argument firstly that these services are for the benefit of society as a whole, and secondly that the individuals who require them are often those who would be least able to pay the economic rate. These arguments can be applied to the facilities for disabled people on Metro.

The best alternative method of appraisal will be as described in Section 1 of this Chapter, while the results are given in Section 2, together with the assumptions made in the course of the calculations of costs and benefits. It was calculated that the benefits which would have to accrue per trip in order for the investment in these facilities to have been worthwhile were:

i) Between about £2.60 and £8.20 in 1986 prices if disabled users only were included;

ii) Between about £0.40 and £1.40 in 1986 prices if all users were taken into account.

It will be remembered that the variation in each case was due to different discount rates being used and different assumptions being made regarding operating costs and future usage trends. An explanation of the possible sources of benefit was given in Section 2. It was stated that, if all the users of these facilities were taken into account, the necessary value of benefits required per trip in order to justify investment would accrue. If, on the other hand, disabled users only were included, the required levels of benefit per trip were said to be less likely but still possible.

The question therefore recurs of whether the cost-effectiveness of the facilities on Metro should be evaluated on the basis of disabled users only or on the basis of all passengers who make use of them. In Section 2 of this Chapter, calculations were made on both these bases, and up to now the results of both sets of calculations have been quoted. However, there are a number of factors in favour of concentrating only on an evaluation which includes all Metro passengers who use these facilities, even though benefits arising from their use by passengers outside the target groups could be described as "windfall" (i.e. unexpected) benefits. Firstly, it is apparent that the target group for which these facilities were intended did in fact include some non-disabled people. Evidence from Section 4 of Chapter 2 shows that, when the facilities for disabled people on Metro were being planned, it was envisaged that other passengers would use them, for example, people with prams, pushchairs, luggage or shopping. Such individuals make up an important percentage of the non-disabled people who use these facilities so that it is essential to include them in calculations of cost-effectiveness. Secondly, it is one of the principles of social cost-benefit analysis that all costs and benefits of a project should be evaluated, wherever and whenever they occur and whether or not they were expected. Thirdly, it is likely that, in any future instance of a system such as Metro being planned, discussions concerning the provision of facilities for disabled people would almost certainly include an assessment of experience gained on the Tyne and Wear system. In such a case, it would be incorrect to give results based only on the use of these facilities by disabled people, as this would show an incomplete picture, as would the omission of any unexpected costs.

Therefore, the real level of benefits necessary for the investment in facilities for disabled people on Metro to be justified will be taken to be that based on all users, i.e. between about £0.40 and £1.40 per trip. Given the likely sources of benefit described in Section 2, it appears quite feasible that this level of benefits will indeed accrue, on average, for every trip involving the use of these facilities. In addition, these figures are below the costs per trip of all the various alternative forms of transport for disabled people analysed in Section 3 of this Chapter.

The facilities for disabled people on Metro can also be compared with the possible alternatives in terms of effectiveness in reaching people. The report published by the City of Newcastle upon Tyne (1985) indicated that only about one-third of all disabled people in Newcastle had been on Metro and about the same proportion of respondents to the survey of wheelchair users in North Tyneside (see Section 5 of Chapter 4) said they had used the system. Mention has already been made of the possible claim that many disabled people who are unable to use Metro because of the distance to the nearest station might be better served by a specialised service offering door-to-door transport. In fact, as reported in Section 3 of this Chapter, American experiences suggest that specialised transport schemes may be less effective than Metro in reaching disabled people. Since most American special transport schemes require would-be users to register with the service before making bookings, the number of registrants can be compared with the total number of eligible individuals within the catchment area of the scheme in question. Texieira (1978), the Transportation Research Board (1983) and Everett (1984) between them show that about 0.3% to 40% of eligible people will in fact register. These services are thus no more successful in penetrating the disabled population than Metro. Moreover, although a demand-responsive service can offer some advantages (such as door-to-door transport) compared to Metro, there are also some drawbacks, such as the need to pre-book. The American wheelchair-accessible bus programme was even less effective in reaching the bulk of the disabled population. Information currently available indicates that the same may well be true of fixed-route wheelchair-accessible bus services in the UK.

A number of other points should be dealt with as follows:

i) If the facilities for disabled people on Metro had not been provided, one possible alternative might have been to subsidise disabled people's use of taxis, since these provide a personalised door-to-door service for those able to use such vehicles. What would the costs of such a scheme have been?

ii) Alternatively, if disabled people and others using the facilities on Metro were charged the "economic rate" for doing so, how would this compare with the costs of alternatives such as taxis?

iii) How does the value of benefits which would have to accrue in order for these facilities to have been worthwhile compare with the average benefits which accrue per trip for Metro as a whole?

iv) How do the benefits which would have to accrue as described earlier compare with Metro fares in general?

Points (i) and (ii) can be answered by reference to Appendix XIII, which gives details of the Hackney Carriage Hire Charges applicable in Newcastle upon Tyne, with effect from March, 1986. On the basis of this farescale, even the shortest journey would cost 70 pence while journeys of one mile and five miles would cost £1.20 and £4.00 respectively. According to Tyne and Wear PTE (1986), Metro carried about 61,000,000 passengers in 1984/85, while passenger miles travelled on Metro amounted to nearly 194,000,000 so that average journey length was approximately three miles. This figure relates to all passengers, able-bodied and disabled, but it seems reasonable to assume that the average Metro trip length is the same for all passengers and for those requiring to use the facilities for disabled people.

Appendix XIII shows that the taxi fare for a journey of this length would be approximately £2.60. Consequently, if the facilities on Metro had not been provided and disabled people had instead been allowed to use taxis free of charge, the cost to local or central government would have been about £2.60 per trip. In comparison, the value of benefits which would have to accrue in order for the investment in the facilities on Metro to have been worthwhile was calculated at between about £0.40 and £1.40. Although it is difficult to make direct comparisons between the two alternatives of a subsidised taxi service and the facilities on Metro, these calculations do tend to bear out the conclusions made earlier in this Section. The facilities on Metro do seem to be justifiable on economic grounds, but only because of the relatively large numbers of non-disabled Metro passengers who also use them.

In point (ii) above, it was asked whether the users of the facilities on Metro would be prepared to pay the "economic rate" for doing so. Again, if disabled people alone were included in a calculation of this kind, the "economic rate" would be between about £2.60 and £8.20 per trip by a disabled person. It is likely that, if charged this amount, many disabled people would prefer to use taxis since an average length Metro trip would only cost £2.60 if made by taxi. However, if it was decided that all passengers using these facilities should pay the "economic rate" for doing so, this would only be between about £0.40 and £1.40 (in addition to the normal Metro fare), which would be much less than the equivalent taxi fare for an average length Metro journey. It should also be remembered that not all disabled people could use a conventional taxi: some such individuals would require a purpose-built vehicle, and the cost of specialised transport systems for disabled people has already been discussed in Section 3 of this Chapter.

Point (iii) above raises the question of average benefits per trip for Metro as a whole, as compared to the benefits needed to offset the costs of the facilities for disabled people. Page 40 of "The Metro Report" produced by Tyne and Wear PTE (1986) shows that, in the year 1984/85, the total net benefit to society of Metro was estimated at nearly £30 million. Annual system ridership over the same period was some 61 million, which gives a net benefit per trip of almost 50 pence. As stated already, a net benefit of between about £0.40 and £1.40 per trip involving the use of facilities for disabled people would have to accrue in order for the investment in them to have been worthwhile. Since benefits worth 50 pence in 1984/85 prices accrued for every trip on Metro, it does seem likely that further benefits worth between about £0.40 and £1.40 in 1986 prices would accrue for every trip involving the use of these facilities, bearing in mind the range of possible sources of benefit given in Section 2 of this Chapter.

Point (iv) introduces the idea of comparing Metro fares with the value of benefits necessary to make the investment in facilities for disabled people worthwhile. According to Tyne and Wear PTE (1986), average Metro journey length in 1984/85 was about three miles. Metro fares are calculated on a zonal rather than a mileage basis, but for most of 1986, a journey of about three miles would cost either 38 pence or 45 pence, depending on the number of zones crossed during the journey. The average level of benefits which would have to occur per trip in order for the facilities on Metro to have been worthwhile is between about £0.40 and £1.40 at 1986 prices, which is higher than the fare for an average length Metro journey, but not greatly so.

Finally, there is the question of whether the cost-effectiveness of individual facilities can be assessed. So far, all the facilities have been evaluated together and have been regarded as indivisible. In general, this is inevitable since, for example, it would be almost pointless to provide wide ticket barriers for wheelchair users and then not install lifts or ramps. However, lifts and ramps would theoretically be interchangeable so it is worth considering the implications of having either ramps at all stations or lifts at all stations, instead of the current mix of lifts at some stations and ramps at others.

If ramps were provided at all stations, the initial capital cost might have been lower than for lifts. Appendices V and VI show that, when the facilities for disabled people were being planned, the projected costs of lift installation were generally higher than the projected costs of ramp construction, with a few exceptions. However, this ignores the fact that, at some stations with lifts, the insertion of a lift shaft or even two lift shafts into plans which had already been prepared was probably much easier and cheaper than the construction of a ramp. At surface stations, ramps do not generally have to span very great vertical distances while at underground stations, extremely long ramps would be required in order to span the necessary change of levels without an excessively steep gradient. This would necessitate either the sinking of a long inclined shaft (for a one-piece ramp) or a large well (for a ramp in zig-zag sections). Either of these options would require alterations to overall station layouts and the costs would be prohibitive. Ramps would probably be much less ergonomically effective in this context than lifts because their great length would undoubtedly be very daunting to many disabled people.

On the other hand, the provision of lifts at suburban stations instead of ramps would certainly have been very costly, possibly without generating any significant increases in usage. Most smaller stations are of conventional layout, i.e. two separate platforms with running tracks in between, so that two lifts would be required in most cases. The number of disabled people using suburban stations is quite small and it is also likely that lifts at these stations would be more prone to vandalism than those at busier stations, so that maintenance costs would increase.

Thus, while it is possible that, at one or two stations, the installation of lifts instead of ramps or vice versa would have been more cost-effective, the current mixed provision is probably the most appropriate, with lifts at busier stations which have the greatest change of levels and ramps at less heavily-patronised suburban stations which are generally closer to surface level.

Finally, it should again be noted that there was considerable variation in the values of benefit necessary per trip in order to justify the investment in facilities for disabled people on Metro and this is the case even after the estimates based on disabled users only are discarded. However, the inclusion in the calculations of a range of possibilities appears justified by the fact that, provided all users of the facilities are taken into account, the facilities remain cost-effective even if pessimistic assumptions are made regarding costs and usage.

The aim of this Chapter has been to evaluate the social cost-effectiveness of the facilities and also to provide comparisons with alternative forms of transport for disabled people. While it may be that no one transport system represents the "best" solution to the needs of disabled people, financial constraints often dictate that only one option is pursued.

Figures - Chapter 6

Figures - Chapter 6 (continued)

Figure 6.1 : Calculation of the total operating costs of the facilities for disabled people, over 30 years, assuming that operating costs are 10% per annum of the capital cost of £11 million and that operating costs are discounted at 7% per annum

Base year = 1986

| Year | Operating cost when discounted | Year | Operating cost when discounted |
|---|---|---|---|
| | £ | | £ |
| 1980 | 1,650,803 | 1995 | 572,452 |
| 1981 | 1,542,807 | 1996 | 532,381 |
| 1982 | 1,441,876 | 1997 | 495,114 |
| 1983 | 1,347,547 | 1998 | 460,456 |
| 1984 | 1,259,390 | 1999 | 428,224 |
| 1985 | 1,177,000 | 2000 | 398,248 |
| 1986 | 1,100,000 | 2001 | 370,371 |
| 1987 | 1,023,000 | 2002 | 344,445 |
| 1988 | 951,390 | 2003 | 320,334 |
| 1989 | 884,793 | 2004 | 297,910 |
| 1990 | 822,857 | 2005 | 277,057 |
| 1991 | 765,257 | 2006 | 257,663 |
| 1992 | 711,689 | 2007 | 239,626 |
| 1993 | 661,871 | 2008 | 222,853 |
| 1994 | 615,540 | 2009 | 207,253 |

| | | |
|---|---|---|
| TOTAL OPERATING COSTS OVER 30 YEARS AT 1986 PRICES | = | £21,380,207 |
| PLUS CAPITAL COST AT 1986 PRICES | = | £11,000,000 |
| TOTAL COST OF FACILITIES FOR DISABLED PEOPLE IN 1986 AT 1986 PRICES | = | £32,380,207 |

Figure 6.2 : Calculation of the "effective" usage of the facilities for disabled people, over 30 years, after discounting at 7% per annum, assuming usage remains static over time and taking into account disabled users only

Base year = 1986

For years before 1986, usage in year n =

(Usage in n + 1) + (7% of usage in n + 1)

For years after 1986, usage in year n =

(Usage in n - 1) - (7% of usage in n - 1)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 1980 | 284,718.0 | + | 19,930.3 | = | 304,648.3 |
| 1981 | 266,091.6 | + | 18,626.4 | = | 284,718.0 |
| 1982 | 248,683.7 | + | 17,407.9 | = | 266,091.6 |
| 1983 | 232,414.7 | + | 16,269.0 | = | 248,683.7 |
| 1984 | 217,210.0 | + | 15,204.7 | = | 232,414.7 |
| 1985 | 203,000.0 | + | 14,210.0 | = | 217,210.0 |
| 1986 | | | | = | 203,000.0 |
| 1987 | 203,000.0 | - | 14,210.0 | = | 188,790.0 |
| 1988 | 188,790.0 | - | 13,215.3 | = | 175,574.7 |
| 1989 | 175,574.7 | - | 12,290.2 | = | 163,284.5 |
| 1990 | 163,284.5 | - | 11,429.9 | = | 151,854.6 |
| 1991 | 151,854.6 | - | 10,629.8 | = | 141,224.8 |
| 1992 | 141,224.8 | - | 9,885.7 | = | 131,339.1 |
| 1993 | 131,339.1 | - | 9,193.7 | = | 122,145.4 |
| 1994 | 122,145.4 | - | 8,550.2 | = | 113,595.2 |
| 1995 | 113,595.2 | - | 7,951.7 | = | 105,643.5 |
| 1996 | 105,643.5 | - | 7,395.0 | = | 98,248.5 |
| 1997 | 98,248.5 | - | 6,877.4 | = | 91,371.1 |
| 1998 | 91,371.1 | - | 6,396.0 | = | 84,975.1 |
| 1999 | 84,975.1 | - | 5,948.3 | = | 79,026.8 |

Figure 6.2 (continued)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 2000 | 79,026.8 | - | 5,531.9 | = | 73,494.9 |
| 2001 | 73,494.9 | - | 5,144.6 | = | 68,350.3 |
| 2002 | 68,350.3 | - | 4,784.5 | = | 63,565.8 |
| 2003 | 63,565.8 | - | 4,449.6 | = | 59,116.2 |
| 2004 | 59,116.2 | - | 4,138.1 | = | 54,978.1 |
| 2005 | 54,978.1 | - | 3,848.5 | = | 51,129.6 |
| 2006 | 51,129.6 | - | 3,579.1 | = | 47,550.5 |
| 2007 | 47,550.5 | - | 3,328.5 | = | 44,222.0 |
| 2008 | 44,222.0 | - | 3,095.5 | = | 41,126.5 |
| 2009 | 41,126.5 | - | 2,878.9 | = | 38,247.6 |
| | | | TOTAL "EFFECTIVE" USAGE | = | 3,945,621.0 |

Figure 6.3 : Calculation of the "effective" usage of the facilities for disabled people, over 30 years, after discounting at 7% per annum, assuming usage remains static over time and taking into account all users of the facilities for disabled people

Base year = 1986

For years before 1986, usage in year n =

(Usage in n + 1) + (7% of usage in n + 1)

For years after 1986, usage in year n =

(Usage in n - 1) - (7% of usage in n - 1)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 1980 | 1,683,062.1 | + | 117,814.3 | = | 1,800,876.4 |
| 1981 | 1,572,955.2 | + | 110,106.9 | = | 1,683,062.1 |
| 1982 | 1,470,051.6 | + | 102,903.6 | = | 1,572,955.2 |
| 1983 | 1,373,880.0 | + | 96,171.6 | = | 1,470,051.6 |
| 1984 | 1,284,000.0 | + | 89,880.0 | = | 1,373,880.0 |
| 1985 | 1,200,000.0 | + | 84,000.0 | = | 1,284,000.0 |
| 1986 | | | | = | 1,200,000.0 |
| 1987 | 1,200,000.0 | - | 84,000.0 | = | 1,116,000.0 |
| 1988 | 1,116,000.0 | - | 78,120.0 | = | 1,037,880.0 |
| 1989 | 1,037,880.0 | - | 72,651.6 | = | 965,228.4 |
| 1990 | 965,228.4 | - | 67,566.0 | = | 897,662.4 |
| 1991 | 897,662.4 | - | 62,836.4 | = | 834,826.0 |
| 1992 | 834,826.0 | - | 58,437.8 | = | 776,388.2 |
| 1993 | 776,388.2 | - | 54,347.2 | = | 722,041.0 |
| 1994 | 722,041.0 | - | 50,542.9 | = | 671,498.1 |
| 1995 | 671,498.1 | - | 47,004.9 | = | 624,493.2 |
| 1996 | 624,493.2 | - | 43,714.4 | = | 580,778.8 |
| 1997 | 580,778.8 | - | 40,654.5 | = | 540,124.3 |
| 1998 | 540,124.3 | - | 37,808.7 | = | 502,315.6 |
| 1999 | 502,315.6 | - | 35,162.1 | = | 467,153.5 |

Figure 6.3 (continued)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 2000 | 467,153.5 | - | 32,700.7 | = | 434,452.8 |
| 2001 | 434,452.8 | - | 30,411.7 | = | 404,041.1 |
| 2002 | 404,041.1 | - | 28,282.9 | = | 375,758.2 |
| 2003 | 375,758.2 | - | 26,303.1 | = | 349,455.1 |
| 2004 | 349,455.1 | - | 24,461.9 | = | 324,993.2 |
| 2005 | 324,993.2 | - | 22,749.5 | = | 302,243.7 |
| 2006 | 302,243.7 | - | 21,157.0 | = | 281,086.7 |
| 2007 | 281,086.7 | - | 19,676.1 | = | 261,410.6 |
| 2008 | 261,410.6 | - | 18,298.7 | = | 243,111.9 |
| 2009 | 243,111.9 | - | 17,017.8 | = | 226,094.1 |
| | | | TOTAL "EFFECTIVE" USAGE | = | 23,323,862.0 |

Figure 6.4 : Calculation of the "effective" usage of the facilities for disabled people, over 30 years, after discounting at 7% per annum, assuming usage changes over time and taking into account disabled users only

Base year = 1986

For years before 1986, usage in year n =

(Usage in n + 1) + (2% of usage in n + 1)

Usage in 1987 assumed to be 17% less than in 1986

For years after 1987, usage in year n =

(Usage in n - 1) - (2% of usage in n - 1)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 1980 | 224,128.4 | + | 4,482.6 | = | 228,611.0 |
| 1981 | 219,733.7 | + | 4,394.7 | = | 224,128.4 |
| 1982 | 215,425.2 | + | 4,308.5 | = | 219,733.7 |
| 1983 | 211,201.2 | + | 4,224.0 | = | 215,425.2 |
| 1984 | 207,060.0 | + | 4,141.2 | = | 211,201.2 |
| 1985 | 203,000.0 | + | 4,060.0 | = | 207,060.0 |
| 1986 | | | | = | 203,000.0 |
| 1987 | 203,000.0 | - | 34,510.0 | = | 168,490.0 |
| 1988 | 168,490.0 | - | 3,369.8 | = | 165,120.2 |
| 1989 | 165,120.2 | - | 3,302.4 | = | 161,817.8 |
| 1990 | 161,817.8 | - | 3,236.4 | = | 158,581.4 |
| 1991 | 158,581.4 | - | 3,171.6 | = | 155,409.8 |
| 1992 | 155,409.8 | - | 3,108.2 | = | 152,301.6 |
| 1993 | 152,301.6 | - | 3,046.0 | = | 149,255.6 |
| 1994 | 149,255.6 | - | 2,985.1 | = | 146,270.5 |
| 1995 | 146,270.5 | - | 2,925.4 | = | 143,345.1 |
| 1996 | 143,345.1 | - | 2,866.9 | = | 140,478.2 |
| 1997 | 140,478.2 | - | 2,809.6 | = | 137,668.6 |
| 1998 | 137,668.6 | - | 2,753.4 | = | 134,915.2 |
| 1999 | 134,915.2 | - | 2,698.3 | = | 132,216.9 |

Figure 6.4 (continued)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 2000 | 132,216.9 | - | 2,644.3 | = | 129,572.6 |
| 2001 | 129,572.6 | - | 2,591.5 | = | 126,981.1 |
| 2002 | 126,981.1 | - | 2,539.6 | = | 124,441.5 |
| 2003 | 124,441.5 | - | 2,488.8 | = | 121,952.7 |
| 2004 | 121,952.7 | - | 2,439.1 | = | 119,513.6 |
| 2005 | 119,513.6 | - | 2,390.3 | = | 117,123.3 |
| 2006 | 117,123.3 | - | 2,342.5 | = | 114,780.8 |
| 2007 | 114,780.8 | - | 2,295.6 | = | 112,485.2 |
| 2008 | 112,485.2 | - | 2,249.7 | = | 110,235.5 |
| 2009 | 110,235.5 | - | 2,204.7 | = | 108,030.8 |
| | | | TOTAL "EFFECTIVE" USAGE | = | 4,640,148.0 |

Figure 6.5 : Calculation of the "effective" usage of the facilities for disabled people, over 30 years, after discounting at 7% per annum, assuming usage changes over time and taking into account all users of the facilities for disabled people

Base year = 1986
For years before 1986, usage in year n =
(Usage in n + 1) + (2% of usage in n + 1)
Usage in 1987 assumed to be 17% less than in 1986
For years after 1987, usage in year n =
(Usage in n - 1) - (2% of usage in n - 1)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 1980 | 1,324,896.9 | + | 26,497.9 | = | 1,351,394.8 |
| 1981 | 1,298,918.5 | + | 25,978.4 | = | 1,324,896.9 |
| 1982 | 1,273,449.6 | + | 25,468.9 | = | 1,298,918.5 |
| 1983 | 1,248,480.0 | + | 24,969.6 | = | 1,273,449.6 |
| 1984 | 1,224,000.0 | + | 24,480.0 | = | 1,248,480.0 |
| 1985 | 1,200,000.0 | + | 24,000.0 | = | 1,224,000.0 |
| 1986 | | | | = | 1,200,000.0 |
| 1987 | 1,200,000.0 | - | 204,000.0 | = | 996,000.0 |
| 1988 | 996,000.0 | - | 19,920.0 | = | 976,080.0 |
| 1989 | 976,080.0 | - | 19,521.6 | = | 956,558.4 |
| 1990 | 956,558.4 | - | 19,131.2 | = | 937,427.2 |
| 1991 | 937,427.2 | - | 18,748.5 | = | 918,678.7 |
| 1992 | 918,678.7 | - | 18,373.6 | = | 900,305.1 |
| 1993 | 900,305.1 | - | 18,006.1 | = | 882,299.0 |
| 1994 | 882,299.0 | - | 17,646.0 | = | 864,653.0 |
| 1995 | 864,653.0 | - | 17,293.1 | = | 847,359.9 |
| 1996 | 847,359.9 | - | 16,947.2 | = | 830,412.7 |
| 1997 | 830,412.7 | - | 16,608.2 | = | 813,804.5 |
| 1998 | 813,804.5 | - | 16,276.1 | = | 797,528.4 |
| 1999 | 797,528.4 | - | 15,950.6 | = | 781,577.8 |

Figure 6.5 (continued)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 2000 | 781,577.8 | - | 15,631.6 | = | 765,946.2 |
| 2001 | 765,946.2 | - | 15,318.9 | = | 750,627.3 |
| 2002 | 750,627.3 | - | 15,012.5 | = | 735,614.8 |
| 2003 | 735,614.8 | - | 14,712.3 | = | 720,902.5 |
| 2004 | 720,902.5 | - | 14,418.0 | = | 706,484.5 |
| 2005 | 706,484.5 | - | 14,129.8 | = | 692,354.7 |
| 2006 | 692,354.7 | - | 13,847.1 | = | 678,507.6 |
| 2007 | 678,507.6 | - | 13,570.1 | = | 664,937.5 |
| 2008 | 664,937.5 | - | 13,298.8 | = | 651,638.7 |
| 2009 | 651,638.7 | - | 13,032.7 | = | 638,606.0 |
| | | | TOTAL "EFFECTIVE" USAGE | = | 27,429,444.0 |

Figure 6.6 : Calculation of the total operating costs of the facilities for disabled people, over 30 years, assuming that operating costs are 5% per annum of the capital cost of £11 million and that operating costs are discounted at 5% per annum

Base year = 1986

| Year | Operating cost when discounted | Year | Operating cost when discounted |
|---|---|---|---|
| | £ | | £ |
| 1980 | 737,053 | 1995 | 346,637 |
| 1981 | 701,955 | 1996 | 329,305 |
| 1982 | 668,528 | 1997 | 312,840 |
| 1983 | 636,694 | 1998 | 297,198 |
| 1984 | 606,375 | 1999 | 282,338 |
| 1985 | 577,500 | 2000 | 268,221 |
| 1986 | 550,000 | 2001 | 254,810 |
| 1987 | 522,500 | 2002 | 242,070 |
| 1988 | 496,375 | 2003 | 229,966 |
| 1989 | 471,556 | 2004 | 218,468 |
| 1990 | 447,978 | 2005 | 207,544 |
| 1991 | 425,580 | 2006 | 197,167 |
| 1992 | 404,301 | 2007 | 187,309 |
| 1993 | 384,086 | 2008 | 177,943 |
| 1994 | 364,881 | 2009 | 169,046 |

TOTAL OPERATING COSTS OVER 30 YEARS AT 1986 PRICES = £11,716,224

PLUS CAPITAL COST AT 1986 PRICES = £11,000,000

TOTAL COST OF FACILITIES FOR DISABLED PEOPLE IN 1986 AT 1986 PRICES = £22,716,224

Figure 6.7 : Calculation of the "effective" usage of the facilities for disabled people, over 30 years, after discounting at 5% per annum, assuming usage remains static over time and taking into account disabled users only

Base year = 1986

For years before 1986, usage in year n =

(Usage in n + 1) + (5% of usage in n + 1)

For years after 1986, usage in year n =

(Usage in n - 1) - (5% of usage in n - 1)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 1980 | 259,085.2 | + | 12,954.2 | = | 272,039.4 |
| 1981 | 246,747.8 | + | 12,337.4 | = | 259,085.2 |
| 1982 | 234,997.9 | + | 11,749.9 | = | 246,747.8 |
| 1983 | 223,807.5 | + | 11,190.4 | = | 234,997.9 |
| 1984 | 213,150.0 | + | 10,657.5 | = | 223,807.5 |
| 1985 | 203,000.0 | + | 10,150.0 | = | 213,150.0 |
| 1986 | | | | = | 203,000.0 |
| 1987 | 203,000.0 | - | 10,150.0 | = | 192,850.0 |
| 1988 | 192,850.0 | - | 9,642.5 | = | 183,207.5 |
| 1989 | 183,207.5 | - | 9,160.4 | = | 174,047.1 |
| 1990 | 174,047.1 | - | 8,702.4 | = | 165,344.7 |
| 1991 | 165,344.7 | - | 8,267.2 | = | 157,077.5 |
| 1992 | 157,077.5 | - | 7,853.9 | = | 149,223.6 |
| 1993 | 149,223.6 | - | 7,461.1 | = | 141,762.5 |
| 1994 | 141,762.5 | - | 7,088.2 | = | 134,674.3 |
| 1995 | 134,674.3 | - | 6,733.7 | = | 127,940.6 |
| 1996 | 127,940.6 | - | 6,397.0 | = | 121,543.6 |
| 1997 | 121,543.6 | - | 6,077.2 | = | 115,466.4 |
| 1998 | 115,466.4 | - | 5,773.3 | = | 109,693.1 |
| 1999 | 109,693.1 | - | 5,484.7 | = | 104,208.4 |

Figure 6.7 (continued)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 2000 | 104,208.4 | - | 5,210.4 | = | 98,998.0 |
| 2001 | 98,998.0 | - | 4,949.9 | = | 94,048.1 |
| 2002 | 94,048.1 | - | 4,702.4 | = | 89,345.7 |
| 2003 | 89,345.7 | - | 4,467.3 | = | 84,878.4 |
| 2004 | 84,878.4 | - | 4,243.9 | = | 80,634.5 |
| 2005 | 80,634.5 | - | 4,031.7 | = | 76,602.8 |
| 2006 | 76,602.8 | - | 3,830.2 | = | 72,772.6 |
| 2007 | 72,772.6 | - | 3,638.6 | = | 69,134.0 |
| 2008 | 69,134.0 | - | 3,456.7 | = | 65,677.3 |
| 2009 | 65,677.3 | - | 3,283.9 | = | 62,393.4 |
| | | TOTAL "EFFECTIVE" USAGE | | = | 4,324,352.0 |

Figure 6.8 : Calculation of the "effective" usage of the facilities for disabled people, over 30 years, after discounting at 5% per annum, assuming usage remains static over time and taking into account all users of the facilities for disabled people

Base year = 1986

For years before 1986, usage in year n =

(Usage in n + 1) + (5% of usage in n + 1)

For years after 1986, usage in year n =

(Usage in n - 1) - (5% of usage in n - 1)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 1980 | 1,531,537.9 | + | 76,576.9 | = | 1,608,114.8 |
| 1981 | 1,458,607.5 | + | 72,930.4 | = | 1,531,537.9 |
| 1982 | 1,389,150.0 | + | 69,457.5 | = | 1,458,607.5 |
| 1983 | 1,323,000.0 | + | 66,150.0 | = | 1,389,150.0 |
| 1984 | 1,260,000.0 | + | 63,000.0 | = | 1,323,000.0 |
| 1985 | 1,200,000.0 | + | 60,000.0 | = | 1,260,000.0 |
| 1986 | | | | = | 1,200,000.0 |
| 1987 | 1,200,000.0 | - | 60,000.0 | = | 1,140,000.0 |
| 1988 | 1,140,000.0 | - | 57,000.0 | = | 1,083,000.0 |
| 1989 | 1,083,000.0 | - | 54,150.0 | = | 1,028,850.0 |
| 1990 | 1,028,850.0 | - | 51,442.5 | = | 977,407.5 |
| 1991 | 977,407.5 | - | 48,870.4 | = | 928,537.1 |
| 1992 | 928,537.1 | - | 46,426.8 | = | 882,110.3 |
| 1993 | 882,110.3 | - | 44,105.5 | = | 838,004.8 |
| 1994 | 838,004.8 | - | 41,900.2 | = | 796,104.6 |
| 1995 | 796,104.6 | - | 39,805.3 | = | 756,299.3 |
| 1996 | 756,299.3 | - | 37,815.0 | = | 718,484.3 |
| 1997 | 718,484.3 | - | 35,924.2 | = | 682,560.1 |
| 1998 | 682,560.1 | - | 34,128.0 | = | 648,432.1 |
| 1999 | 648,432.1 | - | 32,421.6 | = | 616,010.5 |

Figure 6.8 (continued)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 2000 | 616,010.5 | - | 30,800.5 | = | 585,210.0 |
| 2001 | 585,210.0 | - | 29,260.5 | = | 555,949.5 |
| 2002 | 555,949.5 | - | 27,797.5 | = | 528,152.0 |
| 2003 | 528,152.0 | - | 26,407.6 | = | 501,744.4 |
| 2004 | 501,744.4 | - | 25,087.2 | = | 476,657.2 |
| 2005 | 476,657.2 | - | 23,832.9 | = | 452,824.3 |
| 2006 | 452,824.3 | - | 22,641.2 | = | 430,183.1 |
| 2007 | 430,183.1 | - | 21,509.2 | = | 408,673.9 |
| 2008 | 408,673.9 | - | 20,433.7 | = | 388,240.2 |
| 2009 | 388,240.2 | - | 19,412.0 | = | 368,828.2 |
| | | | TOTAL "EFFECTIVE" USAGE | = | 25,562,673.0 |

Figure 6.9 : Calculation of the "effective" usage of the facilities for disabled people, over 30 years, after discounting at 5% per annum, assuming usage changes over time both due to overall ridership changes and extra generated usage and taking into account disabled users only

Base year = 1986

For years before 1986, usage in year n =

(Usage in n + 1) - (5% of usage in n + 1)

Usage in 1987 assumed to be 10% less than in 1986

For years after 1987, usage in year n =

(Usage in n - 1) + (5% of usage in n - 1)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 1980 | 157,077.5 | - | 7,853.9 | = | 149,223.6 |
| 1981 | 165,344.7 | - | 8,267.2 | = | 157,077.5 |
| 1982 | 174,047.1 | - | 8,702.4 | = | 165,344.7 |
| 1983 | 183,207.5 | - | 9,160.4 | = | 174,047.1 |
| 1984 | 192,850.0 | - | 9,642.5 | = | 183,207.5 |
| 1985 | 203,000.0 | - | 10,150.0 | = | 192,850.0 |
| 1986 | | | | = | 203,000.0 |
| 1987 | 203,000.0 | - | 20,300.0 | = | 182,700.0 |
| 1988 | 182,700.0 | + | 9,135.0 | = | 191,835.0 |
| 1989 | 191,835.0 | + | 9,591.8 | = | 201,426.8 |
| 1990 | 201,426.8 | + | 10,071.3 | = | 211,498.1 |
| 1991 | 211,498.1 | + | 10,574.9 | = | 222,073.0 |
| 1992 | 222,073.0 | + | 11,103.7 | = | 233,176.7 |
| 1993 | 233,176.7 | + | 11,658.8 | = | 244,835.5 |
| 1994 | 244,835.5 | + | 12,241.8 | = | 257,077.3 |
| 1995 | 257,077.3 | + | 12,853.8 | = | 269,931.1 |
| 1996 | 269,931.1 | + | 13,496.6 | = | 283,427.7 |
| 1997 | 283,427.7 | + | 14,171.4 | = | 297,599.1 |
| 1998 | 297,599.1 | + | 14,880.0 | = | 312,479.1 |
| 1999 | 312,479.1 | + | 15,624.0 | = | 328,103.1 |

Figure 6.9 (continued)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 2000 | 328,103.1 | + | 16,405.1 | = | 344,508.2 |
| 2001 | 344,508.2 | + | 17,225.3 | = | 361,733.5 |
| 2002 | 361,733.5 | + | 18,086.7 | = | 379,820.2 |
| 2003 | 379,820.2 | + | 18,991.0 | = | 398,811.2 |
| 2004 | 398,811.2 | + | 19,940.6 | = | 418,751.8 |
| 2005 | 418,751.8 | + | 20,937.6 | = | 439,689.4 |
| 2006 | 439,689.4 | + | 21,984.5 | = | 461,673.9 |
| 2007 | 461,673.9 | + | 23,083.7 | = | 484,757.6 |
| 2008 | 484,757.6 | + | 24,237.8 | = | 508,995.4 |
| 2009 | 508,995.4 | + | 25,449.8 | = | 534,445.2 |
| | | | TOTAL "EFFECTIVE" USAGE | = | 8,794,099.0 |

Figure 6.10 : Calculation of the "effective" usage of the facilities for disabled people, over 30 years, after discounting at 5% per annum, assuming usage changes over time both due to overall ridership changes and extra generated usage and taking into account all users of the facilities for disabled people

Base year = 1986

For years before 1986, usage in year n =

(Usage in n + 1) - (5% of usage in n + 1)

Usage in 1987 assumed to be 10% less than in 1986

For years after 1987, usage in year n =

(Usage in n - 1) + (5% of usage in n - 1)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 1980 | 928,537.1 | - | 46,426.8 | = | 882,110.3 |
| 1981 | 977,407.5 | - | 48,870.4 | = | 928,537.1 |
| 1982 | 1,028,850.0 | - | 51,442.5 | = | 977,407.5 |
| 1983 | 1,083,000.0 | - | 54,150.0 | = | 1,028,850.0 |
| 1984 | 1,140,000.0 | - | 57,000.0 | = | 1,083,000.0 |
| 1985 | 1,200,000.0 | - | 60,000.0 | = | 1,140,000.0 |
| 1986 | | | | = | 1,200,000.0 |
| 1987 | 1,200,000.0 | - | 120,000.0 | = | 1,080,000.0 |
| 1988 | 1,080,000.0 | + | 54,000.0 | = | 1,134,000.0 |
| 1989 | 1,134,000.0 | + | 56,700.0 | = | 1,190,700.0 |
| 1990 | 1,190,700.0 | + | 59,535.0 | = | 1,250,235.0 |
| 1991 | 1,250,235.0 | + | 62,511.8 | = | 1,312,746.8 |
| 1992 | 1,312,746.8 | + | 65,637.3 | = | 1,378,384.1 |
| 1993 | 1,378,384.1 | + | 68,919.2 | = | 1,447,303.3 |
| 1994 | 1,447,303.3 | + | 72,365.2 | = | 1,519,668.5 |
| 1995 | 1,519,668.5 | + | 75,983.4 | = | 1,595,651.9 |
| 1996 | 1,595,651.9 | + | 79,782.6 | = | 1,675,434.5 |
| 1997 | 1,675,434.5 | + | 83,771.8 | = | 1,759,206.3 |
| 1998 | 1,759,206.3 | + | 87,960.3 | = | 1,847,166.6 |
| 1999 | 1,847,166.6 | + | 92,358.3 | = | 1,939,524.9 |

Figure 6.10 (continued)

| Year | Base | | Discounted Element of usage | | "Effective" Usage |
|---|---|---|---|---|---|
| 2000 | 1,939,524.9 | + | 96,976.2 | = | 2,036,501.1 |
| 2001 | 2,036,501.1 | + | 101,825.1 | = | 2,138,326.2 |
| 2002 | 2,138,326.2 | + | 106,916.3 | = | 2,245,242.5 |
| 2003 | 2,245,242.5 | + | 112,262.1 | = | 2,357,504.6 |
| 2004 | 2,357,504.6 | + | 117,875.2 | = | 2,475,379.8 |
| 2005 | 2,475,379.8 | + | 123,769.0 | = | 2,599,148.8 |
| 2006 | 2,599,148.8 | + | 129,957.5 | = | 2,729,106.3 |
| 2007 | 2,729,106.3 | + | 136,455.3 | = | 2,865,561.6 |
| 2008 | 2,865,561.6 | + | 143,278.1 | = | 3,008,839.7 |
| 2009 | 3,008,839.7 | + | 150,442.0 | = | 3,159,281.7 |
| | | | TOTAL "EFFECTIVE" USAGE | = | 51,984,819.0 |

Figure 6.11 : Summary of estimates of costs per trip of various special transport services for disabled people

| Source | Services analysed | Approx. Cost per trip (£ sterling, 1986 prices) |
|---|---|---|
| Burckhardt (1980) | Five experimental special services in USA | £3 to £27 |
| Pio (1980) | Survey of urban special services in USA | £1 to £18 |
| Bailey and Layzell (1983) | Stockholm special transport service | £22 |
| Bailey and Layzell (1983) | Special transport in USA | £1 to £4 |
| Transportation Research Board (1983) | Special transport in USA | £1 to £10 |
| Bailey (1984) | Survey of 10 special services in UK | £4 to £18 (average £8) |
| Bowlby et al (1984) | Special service in Reading, Berkshire | £5 |
| Burckhardt et al (1984) | Survey of 49 special services in USA | £1 to £11 |

All figures are rounded to the nearest whole £1.

# CHAPTER 7 :

# CONCLUSIONS

## 7.1 The effectiveness of the facilities for disabled people on Metro and wider issues concerning transport for disabled people

The findings given in earlier Chapters of this thesis will be placed in a wider context, to enable concluding remarks to be made. These conclusions and a discussion of wider issues are given in this Section, together with suggestions for further research.

In Chapter 2, the development of the facilities for disabled people on Metro was discussed. Evidence shows that the initial system plans did not include very extensive provision for disabled people, but external pressure was the main factor behind the adoption of improved facilities. Eventually, the whole system was designed to be accessible but only very rudimentary investigations were carried out regarding likely levels of usage and the probable cost-effectiveness of these facilities. In fact, the surveys of disabled people which were analysed in Chapter 3 suggested that about 7% of the population of the Tyne and Wear area had some disability, but not all of these disabled people would use Metro. Housebound disabled people and those who are unable to venture far out of doors are not likely to use Metro very often. This leaves a group of disabled people, comprising about 2% of the population of Tyne and Wear, able to walk or travel by wheelchair more than about 100 yards (with assistance if necessary) as the most likely disabled users of Metro. Other disabled people will no doubt use Metro, but this 2% represents the group with the highest potential use of Metro among such individuals. Evidence from Chapter 3 also indicated that disabled people generally had lower than average incomes and car ownership, while there were also higher percentages of females, elderly people and one-person households among disabled people than among the population as a whole.

Various surveys of the use of Metro by disabled people were analysed in Chapters 4 and 5. The results of these surveys showed, firstly, that only about 0.3% to 0.5% of Metro users were disabled. This suggests that disabled people were "under-represented" among Metro users, both in relation to the percentage of all disabled people in the population generally and also in relation to the percentage of disabled people most likely to use Metro. Secondly, it appeared that only a minority (perhaps about one-third) of disabled people had used Metro and those who had been on the system travelled only infrequently. As described in Section 3 of Chapter 6, most of the other forms of transport for disabled people also had low penetration rates and were used by only a minority of those for whom they were intended. However, it was found that the facilities on Metro were also used by non-disabled passengers, many of whom, such as people with prams, pushchairs, luggage or shopping, or cleaning staff moving heavy equipment, could be described as "legitimate" users. Indeed, use by such groups was envisaged from an early stage. In fact, these non-disabled people were so numerous that they comprised between about 80% and 90% of users.

As regards disabled people's opinions of Metro, Chapter 5 contained an ergonomic analysis of the facilities. It appeared that, where provision for disabled people had complied with the specifications laid down by Goldsmith (1976), the facilities performed reasonably well. However, at older stations inherited from British Rail, where items such as ramps had not been designed with disabled people in mind, more problems were reported. Even so, some of the newly-built facilities also seemed to cause difficulty. In particular, the lifts (which were smaller than the dimensions recommended by

Goldsmith) were criticised as being too small. Moreover, provision for visually impaired people was less extensive than that for physically handicapped people.

Chapter 6 comprised an assessment of the cost-effectiveness of the facilities for disabled people. It was calculated that, if only disabled users were taken into account, benefits averaging between about £2.60 and £8.20 per trip in 1986 prices would have to accrue over the expected 30-year life of these facilities in order for the investment to have been worthwhile. While these figures compare favourably with most of the alternative forms of transport for disabled people studied in Section 3 of Chapter 6, it is debatable whether this level of benefits will really accrue.

If, however, all users of these facilities were taken into account, the benefits required per trip fell to between about £0.40 and £1.40. Bearing in mind all the possible sources of benefit described in Section 2 of Chapter 6, it is very likely that benefits of this value would accrue. Thus, it seems that the investment in facilities for disabled people on Metro can be justified if "windfall" benefits, arising from usage by non-disabled people which was only partially anticipated, are included. If these "windfall" benefits are taken into consideration, then the facilities on Metro appear both to be cost-effective in terms of justifying the investment and also to be a better use of resources than any of the alternative forms of transport for disabled people.

Probably the most important point to remember about the likely benefits is that many will be cross-sectoral. As pointed out in Chapter 6, most organisations, whether in the private or public sector, seek to reduce their own costs, irrespective of the effect this may have on costs in other sectors. However, the kind of benefits which will accrue from any form of transport for disabled people, including Metro, will not be reaped by the providers of that transport. Instead, benefits will accrue to users, to those concerned with caring for users and also to public and private sector bodies involved with the welfare of disabled people.

It was also pointed out in Chapters 5 and 6 that neither Metro nor other forms of transport for disabled people had yet succeeded in attracting use from more than a minority of disabled people. Moreover, those disabled people who did use Metro or alternatives tended to travel only infrequently. Thus, although particular individuals might reap considerable benefits, many of the cross-sector benefits had not yet been fully realised. The obvious solution to the problem of low usage would be to encourage increased ridership. Evidence from various other forms of transport for disabled people indicates that patronage will rise over time and there is no reason to suppose that Metro will not produce similar results.

However, in the case of many specialised transport schemes, increased ridership will not necessarily result in improved cost-effectiveness. The study by McKnight (1986) has already been cited in Chapter 6: she points out that specialised transport schemes tend to have high marginal costs in relation to average costs and extra capacity will not yield many economies of scale. In the case of a system such as Metro, facilities for disabled people will have a high average cost and a relatively low marginal cost so that increased usage will result in a lower average cost per trip. While cost-effectiveness can therefore be improved by encouraging more disabled people to make greater use of the system, allowing non-disabled passengers to use the facilities will probably be an equally effective way of increasing usage and reducing average costs per trip. In the case of Metro, where the current levels of usage by non-disabled people were almost certainly not fully envisaged, cost-effectiveness of the facilities is heavily reliant upon "windfall" benefits. The question of whether to include such "windfall" benefits was discussed in Chapter 6 and on balance appears to be justified.

Future instances of provision for disabled people on public transport would be able to take full account of likely use by non-disabled people and almost for this reason alone, it seems that disabled-accessible public transport may well be more cost-effective than specialised schemes. The only exceptions might be cases such as the American wheelchair-accessible bus programme, where provision for disabled people did result in greatly increased operating costs.

Although the cost-effectiveness of facilities for disabled people on a system such as Metro can be improved by allowing use by non-disabled passengers, this does not help to improve the mobility of disabled people, the majority of whom, it seems, would not at present use either accessible public transport or a specialised service. Evidence from Chapter 5 suggests that the main reasons for non-use of Metro by disabled people were more concerned with poor overall mobility and other general problems arising from disability rather than any specific shortcomings of the system. The sources cited in Section 3 of Chapter 6 indicate that the same may be true for specialised services and any advantages of door-to-door schemes are outweighed by drawbacks such as the need to pre-book.

It is perhaps more important to concentrate on ways of improving the overall mobility of disabled people rather than to debate the merits of various kinds of transport for them. The surveys analysed in Chapter 3 showed that many disabled people were elderly, impoverished and isolated from society, so that disability was not one problem but several. In many cases, there may be a resigned acceptance of this situation which will not necessarily be altered by an improvement in the supply of transport for disabled people. Advancing age is often accompanied by bewilderment at, and rejection of, modern society and a consequent unwillingness to venture out or to try anything new. Poverty will only exacerbate this problem since there may be little point in going out when there is no money to spend, even if transport is provided free of charge. It may have to be accepted that some severely disabled people will never be able to live a fully independent and mobile existence, but this need not be the case for everyone.

There is no one single solution and any proposal will inevitably involve increased expenditure. Problems of low income among disabled people could be solved by an increase in welfare benefits. Some such individuals would doubtless be able to enjoy increased mobility as a result, but it may be too late to help many of today's disabled people out of the vicious circle of disability, poverty and isolation. A longer-term solution would require improvements in the infrastructure of society in order to cater for disabled people, accompanied by increased welfare benefits and a framework of support, therapy and counselling. These changes would hopefully ensure that disabled people were not left to decay at home with no-one to care for them. Any lingering prejudice that age or disability inevitably lead to individuals becoming inferior or sub-normal needs constantly to be challenged. The financial costs of a long-term commitment to such a policy would initially be high, although there would be some eventual savings as more disabled people remain able to continue as economically productive members of society. If such a policy were pursued, future generations of disabled people would enjoy greater mobility than their present-day counterparts. This would lead to greater demand for facilities such as those on Metro, but higher usage would mean that capital costs would be offset by more widely-distributed benefits.

There is no doubt that, if a policy such as that outlined above were followed, the facilities for disabled people on Metro would play a much more important part in promoting and maintaining the mobility levels of such individuals. At the present time, however, additional research requires to be undertaken on the practicality of such a policy and the best means of carrying it out, if adopted. Questions of cost-effectiveness would again have to be raised. Although such research is outside the scope of this thesis, it is hoped that the present work will encourage further studies to be carried out along the lines suggested above.

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