1990

PEDESTRIANISATION IN PLYMOUTH: THE EFFECT ON CAR USERS' ACCESSIBILITY TO AND WITHIN THE TRAFFIC FREE ZONE

MEATON, JULIA

http://hdl.handle.net/10026.1/784

http://dx.doi.org/10.24382/3392
University of Plymouth

PEDESTRIANISATION IN PLYMOUTH: THE EFFECT ON CAR USERS' ACCESSIBILITY TO AND WITHIN THE TRAFFIC FREE ZONE

JULIA MEATON

A thesis presented to the Council of National Academic Awards in partial fulfilment of the requirements for the degree of Doctor of Philosophy

Department of Shipping and Transport
Polytechnic South West
Plymouth

In collaboration with: -
Plymouth City Council

September 1990

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PEDESTRIANISATION IN PLYMOUTH; THE EFFECT ON CAR USERS' ACCESSIBILITY TO AND WITHIN THE TRAFFIC FREE ZONE

by JULIA MEATON

When pedestrianisation was introduced in Plymouth, in February 1987, there were two important physical changes to the city centre; environment changes and accessibility changes. Environmentally, the city centre was improved aesthetically and also in terms of safety for pedestrians, less congestion, and ease of movement within the traffic free zone. The process of pedestrianisation initially reduced the accessibility of the city centre, particularly for car users, because the scheme removed nearly all the on-street parking meters together with two small short stay car parks. This caused a temporary reduction in car parking facilities, and the replacement facilities, completed in late 1988, were located at longer walking distances from the shops. Car users' access to the car parks and from the car parks to the shops was therefore changed. Previous experience in other cities has shown that accessibility to newly pedestrianised areas is of paramount importance and in Plymouth this was particularly evident when car users' accessibility problems became the most controversial aspect of the scheme.

Conventional methods of appraising the success or otherwise of pedestrianisation schemes have tended to concentrate on commercial indicators such as trade turnover or on the acceptance of the scheme measured by studying peoples' attitudes and opinions. This research develops a conceptual and operational model that looks predominantly at the behaviour of the city centre users and which focuses on the particular problems experienced in the city, namely the changes in accessibility for the car user. The methodology examines the car users' travel, parking and shopping behaviour at three stages of the city centre's development; before pedestrianisation was introduced, during it s construction and after it s completion. The research was therefore able to discover how people adapted their behaviour in response to the changes in the city.

The research found that many car users adopted a more leisurely approach to visiting the city centre, reflecting it s new image of a recreational as well as a retail shopping centre. Attitudes towards pedestrianisation also changed significantly during the survey period, and were found to be strongly related to respondents' experiences and perceptions of the parking facilities.

ACKNOWLEDGEMENTS

During the course of this study I have been overwhelmed by the cooperation and assistance offered to me by the many people with whom I have come into contact. I would like to take this opportunity to thank them all. In particular I would like to thank:

My supervisor, Dr Richard Gray, whose considerable support and guidance combined with unbridled humour helped me to maintain my enthusiasm and commitment to the project. I would also like to thank my second supervisor, Dr Brian Chalkley for his invaluable assistance and support.

The many Plymouth residents who provided the data necessary for this thesis.

The staff in the Faculty of Maritime Studies for their guidance and assisitance throughout the project.

All members of the Coffee Club, past and present, for their general support. I especially would like to thank Dr Geoff Millward for his continual interest and faith in my work, and Wendy Baker, for coming to my aid at times of crisis.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the research

Pedestrianisation was introduced in Plymouth's city centre on 2nd February 1987, after years of delay. Even in the 1943 'Plan for Plymouth', the main street, Armada Way, was envisaged as a 'no road or traffic approach'. Several schemes had been proposed for Plymouth but all had been rejected and the scheme implemented in 1987 was itself delayed for six months. The main opposition towards these proposals concerned the loss of the on-street parking meters and the resulting lack of parking facilities. Traders were concerned that this would reduce the number of people visiting the city centre and some city-centre users felt that their access might be impaired. Since pedestrianisation these issues have been the major criticisms of the scheme.

A high level of accessibility for all city-centre users is known to be of great importance to retailing centres, particularly if the centre is to be pedestrianised (TEST 1981, Carlson and Carlson 1974). Poor accessibility can mean loss of business to the city-centre retailers as people will increasingly choose alternative retail outlets with better access to do their shopping. In Plymouth it is the car users who have had their accessibility most significantly reduced because of the loss and relocation of parking facilities.

The research aims to assess the changes in accessibility for the car user in terms of parking facilities. Traditional methods of evaluating parking standards are generally limited to the numbers provided and their occupancy and turnover rates. This research, although concerned with these factors, also aims to include the effect of user behaviour and attitudes on the use of these facilities and will examine their link with the accessibility of the city centre. This will then provide information on how people have adapted their behaviour since pedestrianisation, and whether the trade-off between reduced accessibility and an improved environment is acceptable to them.

1.2 Research Objectives

The research project will provide detailed information on the changes that have occurred in the city centre since pedestrianisation. The study of the physical changes is a major part of this work but the impact these have on city-centre users will form the main component of the project. Retailers' attitudes towards the scheme will also be examined. The response of city centre pedestrians will be monitored in terms of their attitudes and behaviour, again before and after the scheme's introduction.

The PhD element of this research is the construction of a model to describe the impact of pedestrianisation on the accessibility of

Plymouth city centre to car-borne shoppers and how this may be reflected in car users' attitudes and behaviour in the city centre. The model, examines the behavioural and attitudinal changes of car users alongside the physical changes in the city centre, particularly the level of parking provision following the pedestrianisation of the city centre. The model aims to evaluate the success or otherwise of the pedestrianisation scheme in terms of car users' acceptance of the scheme demonstrated by their attitudes and behaviour.

1.3 Chapter Development

In order to develop a research model that is able to facilitate the exploration of these topics, it was necessary to undertake a series of literature reviews. The first of these, Chapter 2, examines the history of pedestrianisation and traces the implementation of schemes in Europe, Canada, the U.S.A. and the United Kingdom. The chapter also describes some of the main issues that arise when pedestrianising and outlines the suggestions various researchers make in order to minimise them.

Chapter 3 is concerned with the history of pedestrianisation in Plymouth and traces the city's development from its reconstruction after the war to the present day. The variety of pedestrianisation proposals are examined and the reasons for their rejection are discussed. The chapter finally considers the plan implemented in 1987 and investigates the problems and controversies surrounding it's introduction.

Accessibility is one of the main problems facing towns and cities when they are pedestrianised and the experience in Plymouth confirmed that it is of major importance for the success of such schemes. Chapter 4 therefore considers the nature of accessibility, how it has been defined and the methods past researchers have used in order to study it.

Because this thesis is concerned with the way individuals behave in a shopping environment, it was also necessary to consider past research on factors determing shopping behaviour. Chapter 5 examines some of the literature on consumer behaviour and discusses various spatial models, behavioural models and shopper movement studies.

The reviews of both the accessibility and the consumer behaviour literature revealed that the value of time as an important factor in determing individuals' behaviour. This is obviously an important concept that is pertinent to the main research area of this thesis and for this reason, Chapter 6 contains a brief summary of past research in this field.

Chapter 7 explains the derivation of the conceptual model that was applied to the study of pedestrianisation in Plymouth. It draws a number of theoretical points from the preceding literature reviews and explains their relevance to the present study. Chapter 8 is concerned with how the conceptual model can be operationalised and discusses the survey methods employed, the sampling procedure, and the questionnaire design.

Chapters 9 to 12 examine the results of the surveys. Chapter 9 is concerned primarily with changes in all variables over time, while Chapter 10 looks in more detail at the inter-relationships between the component parts of the model. Chapter 11 looks at the relationships between behaviour and socio-economic characteristics and attitudes towards pedestrianisation. Chapter 12 takes the analysis one stage further and investigates how discriminant analysis can be used as a tool for finding out which variables are the most important for predicting shopping behaviour and attitudes towards pedestrianisation.

Chapter 13 summarises the main conclusions arising from this work and examines how this information could have been applied with hindsight and what lessons have been learnt. The application of the research model in other areas is also discussed.

CHAPTER TWO

A REVIEW OF PAST RESEARCH INTO PEDESTRIANISATION

2.1 Introduction

Pedestrianisation is one of the many traffic restraint policies adopted in urban areas to counter the growing problems of congestion, environmental pollution, poor pedestrian safety and the economic decline of city centres. The review examines the history of pedestrianisation in America, Europe and the U.K. and looks at some of the methods employed to evaluate the various schemes.

One of the main reasons for the growth of cities is the need for people to gain access to a large number of services, with the resulting agglommeration minimising transport requirements (Thompson 1977). The transport needs, however, instead of disappearing, have become concentrated in a dense area, and paradoxically, access to services becomes constrained. Urban areas now suffer considerably from the disadvantages of motorisation and experience congestion, pollution, accidents and other environmental problems. The increase in traffic has for some time reached the stage where it impairs both the level of service efficiency and the quality of life (OECD 1975). Schaeffer and Sclar (1980) believe that the car in particular has 'reached the limit of its ability to enhance access'.

The growing urban problem was highlighted by Buchanan's report (1963) which served as a catalyst for further research into the conflict between accessibility and the environment. Much of this work, however, concentrated on methods of accommodating the car into the cities (Hillman 1983) and the resulting transport policies incorporated this bias by assuming that the majority of people have the use of a car. This overlooks the substantial proportion of the population who, for a variety of reasons, do not have the choice of a car as a mode of transport. (Hillman, Henderson and Whalley 1973, Bendixon 1973, Faulkes 1981). Non-governmental travel surveys found that between 41.8% and 44.5% of all trips are made on foot and that almost all other journeys involve some walking at the beginning or at the end of the trip (Rigby 1977, Elkington, McGlynn and Roberts 1976). Roberts (1980) calculated that there is a potential walking population of 48m in Britain, compared with only 20m potential driving licence holders and he suggests that more should be done to encourage and incorporate the pedestrian into the urban environment. Fruin (1972) believes that pedestrians are inconvenienced and endangered by the growing traffic flows, a problem that is particularly evident in American cities (Pushkarev and Zupan 1975). Increasing accident rates are indicative of the pedestrian/vehicular conflict (Elkington et al 1976, Todd and Walker 1980), and other research has shown that pedestrians suffer inconveniences ranging from poor physical pavement conditions to considerable difficulties of access (Bennison 1980, NCC 1987).

In the 1970s, interest in the pedestrians' welfare began to grow, although more research was regarded as essential so that the planners could cater for them in future projects (Collier and Lehrman 1973). Progress in this field has centred on developments such as New Towns, public transport initiatives, traffic restraint and pedestrianisation. Walsh (n.d.), for example, examined walking requirements and, drawing from the experiences of the Woonerf schemes in the Netherlands (Kraay 1986, Jonquire 1978) suggested ways of designing for pedestrians in newly developing residential areas. Levison (1983) examined a variety of traffic management schemes and car-free zones. Bendixon (1982) examined aspects of town and transport planning, such as car and street design, that could improve the city environment for the pedestrian. He also compared the different approaches to transport planning adopted by two New Towns; Milton Keynes was planned primarily for the car user while in contrast Runcorn concentrated on the provision of a comprehensive public transport system. In Nottingham (Traffic Advisory Unit, 1979) a policy of traffic restraint aimed to keep the car out of the centre and encourage the use of public transport.

Antoniou (1971) outlined ideas for accommodating the pedestrian based on movement patterns, pedestrians paths and nodes and suggested design standards for walkways, stairs, lighting etc. Whilst there has been a lot of work in the 'design area' (Design Council 1979, Wiedenhoeff 1981, Unterman 1984, Mitchell 1986), there has also been considerable progress in planning and architecture which not only adapt the features of the environment, but actually change the environment so it becomes a pedestrian enclave.

The idea of pedestrianisation was not new; Leonardo de Vinci recognised the potential benefits of vehicle/pedestrian segregation, and purpose- built arcades have been around for some time (Mackeith 1986). However, it has only been relatively recently that the concept of converting traffic streets has been applied in urban areas. In Europe the Germans are the pioneers of pedestrianisation (Monheim 1986, Hajdu 1981) and in 1929 Essen became the first city to convert an all-purpose traffic street into one given over to pedestrians (Roberts 1981). Rudofsky (1969) was an early advocate for pedestrian streets and compared the urban street environment of American cities with those of the Romans. Kalamazoo in Michigan was the first street conversion in America (1959), and Norwich was the first in Britain in 1967 (Roberts 1981, Carlson and Carlson 1974).

In Britain there is a large amount of legislation referring to the pedestrian and the roads, but the two Acts most relevant to pedestrianisation itself are the Highways Act 1971 and the Town and Country Planning Act, 1972 (Elkington et al 1976) which include the necessary legislation that provides for the formation of pedestrian zones. The first allows local authorities to enter an agreement with building owners for the creation of walkways through buildings, and the second allows highways to be blocked off and the traffic redirected. Sections 212 and 213 allow for the conversion of highways into footpaths and the Act also contains powers to assist local authorities to create pedestrian precincts and to close streets to certain types of traffic.

When London Street, Norwich was converted in 1967 (Wood 1969), neither of these two Acts were in force. This was overcome by citing the need to close the street on the grounds of pedestrian safety, which was provided for in the Road Traffic Regulation Act 1967, which gave local authorities the power to make a traffic order for 'avoiding danger to persons using the road'.

2.2 The Pedestrianisation Experience

Roberts' (1981) study of British pedestrian precincts identified 1,450 zones, of which a third were conversions from all-purpose streets. The main era for their growth was the 1970s. The reasons for pedestrian-isation were found to be varied, but were not dominated by the desire to cater for the safety of the pedestrian. Most conversions were for economic/commercial reasons with the safety aspect being almost incidental. The size of the schemes varies from single street to large networks and the average width of the pedestrian streets is just under 20m.

The environmental benefits are widespread and research suggests that the improvements are acknowledged and appreciated by the public. An

OECD (1975) study of converted streets in 105 cities showed that noise levels have decreased in 86% of cases and air pollution decreased in 72%. Accident rates often fall following pedestrianisation; in Gothenburg a reduction of 20% was recorded. Roberts recognises the importance of accessibility for both the retailers (for goods deliveries) and the shoppers (to gain easy access to the shops) , but questions the assumption that rear delivery access is essential before pedestrianisation can be attempted and cites the example of Germany where this is not always possible but alternative arrangements generally prove to be adequate.

Public transport is seen to be important and Roberts examines the different approaches adopted to accommodate bus services either in or close to the traffic-free zone. There is little evidence of problems of displaced traffic. Rarely are new streets built after pedestrianisation but little congestion occurs, suggesting that much of the previous traffic disappears as it no longer needs to be there.

The attitudes of people towards the conversions is generally favourable and Roberts quotes various examples. In Wakefield, 65% liked the new precinct and half were satisfied with access. 84% of households in Wandsworth considered the pedestrians' environment to have improved following the introduction of a scheme and in Seaham, County Durham, a postal survey showed that 88% of households thought safety had improved. However, in Watford a rise in the number of accidents involving pedestrians accompanied the introduction of a scheme and the public did not support it until the problem had been resolved. Retailers were found initially to resist pedestrianisation in the majority of cases, mainly because of fears about losing trade. The evidence of 18 towns and cities undermines this concern since trade was seen to increase in 16 of them. Data from the OECD (1978) showed that 49% of 105 cities experienced an increase in trade, while 25% recorded no improvement and only 2% registered a reduction. Generally, the pedestrianisation of a street is beneficial to trade although if it is too successful it may lead to higher rates and rents. The Multiple Retailers Association (1972) lists three essential prerequisites for pedestrianisation that should safeguard the commercial interests in the town or city:

1. Consultation with retailers, particularly with regard to servicing requirements.

2. Alternative routes for public transport close to the shops.

3. Adequate parking within 200m from the shops.

Roberts' findings support the observations made by Gray (1966) in his reseach in 10 European cities. The streets he studied were very different, being a combination of old and new, although none were excessively wide. Rear access was thought to be important but Gray found that where this was not possible, delivery problems could be overcome in a number of ways including restricted time deliveries and the use of trolleys. Adequate parking was deemed necessary by most cities but the criteria used for measurement varied, particularly with regard to maximum walking distances which ranged from 300 to 500 yards. Initially most schemes met with opposition from the traders but after increases in retail turnover and positive reactions from the public, they eventually welcomed the initiatives.

Research by the GLC (1972) concerning 15 European and American cities that had experimented with pedestrianisation showed similar results. The main issues surrounding the schemes were trade turnover and accessibility for both delivery vehicles and shoppers, particularly the car user. Retail sales have increased in almost all cities; in Dusseldorf turnover was up by 36% to 40% and in Munich a 40% increase was reported. Traders were often found to be initially against the schemes as in Dusseldorf and The Hague, but again these opinions were reversed once trade was seen to rise. Ample car parking facilities were regarded as important in most of the cities. In Gothenburg and Vienna parking facilities were restricted and this concerned retailers. Dusseldorf provided plentiful facilities and in The Hague the local authorities adopted a policy that walking distances from car parks should not exceed 300m. Recent research in Germany, however, suggests that people are prepared to walk considerably further than these earlier estimates (Hall and Hass-Klaus 1985); in Essen the average walking distance, on a trip to the city-centre, was 1200m for all pedestrians. In Dusseldorf this was 1550m. Car users were found to walk less far, in Essen their average walking distance was 724m.

Brambilla and Longo (1977) have carried out research into the experiences of pedestrianisation in European cities but have also studied the experiences of North America. Their work illustrates the similarity of the main issues that arise, i.e. concern about accessibility and trade. Most pedestrianised areas were regarded as successful, but greater emphasis was placed on the problems of competition from out-of- town stores, probably a reflection of the higher levels of motorisation in the U.S.A. Pedestrianisation was also commonly introduced as part of a much wider overall plan for revitalising the 'downtown' areas of the cities.

The literature available on case studies of pedestrianisation illustrates the great diversity of the schemes that have been implemented (OECD 1974, Uhlig 1979, Perkins n.d.). They have been introduced in a wide range of different areas, from very rural locations such as Polperro in Cornwall (Pitts 1979) to the dense urban environment of Madison Avenue, New York (GLC 1972). London has also experimented with pedestrianisation in a limited way and more ambitious projects are frequently put forward (TEST 1985, Roberts 1986). However, there appears to be worldwide agreement on the main factors that govern the success or failure of the schemes.

Onibokun's (1975) investigation of 23 American towns with pedestrian malls showed that 85% had reversed the image of the declining downtown area with pedestrian flows and trade increasing. All the respondents stated how important it was to get the City Council, the Chamber of Commerce, traders associations and the general public involved in the scheme from the outset. The general recommendations are the need for a feasibility study, joint responsibility, a strong traders' association and co-operation between all those involved. More detailed recommend- ations included the need to control deliveries, the prohibition of cycles and obstructions in the emergency lanes and a regulated access system. The two major problems experienced by the towns concerned the shortage of parking spaces and delivery problems.

Carlson and Carlson (1974) examined the impact the introduction of a pedestrianisation scheme can have on the retail economy of the city. They concluded that pedestrianisation can help to arrest the trend towards out of town shopping facilities, but only if it is introduced within the framework of an overall strategic plan. Particularly important are traffic management, access and parking and they state that 'in no case will a mall work without upgrading these factors', concluding that the malls with the best records of success are those which have plentiful parking facilities before the scheme's introduction. Boesal (1966) and Barry (1966) also emphasise the need for a scheme to be introduced alongside overall improvements to these services.

In the previous case studies, the attitudes of the public are seen to be important to the success or otherwise of a pedestrianisation scheme. In the following more detailed studies this particular aspect is examined in more depth.

Clyde (1976) studied user attitudes to the pedestrianisation of Church Street, Liverpool. Before and after surveys were carried out using an unstructured questionnaire asking people about their impressions of the street. The after survey revealed that 76.5% of the impressions collected were favourable, while 23.5% were not. This was compared with the before survey in which 67% of impressions were un-favourable. Copley (1975), also studying the impact of pedestrianisation in Church Street, concentrated on the actual behaviour of the pedestrians. There was found to a decrease in the accessibility of the central area with pedestrians having to walk further, particularly if they arrived by bus. Pedestrians also seemed to be visiting fewer shops and walking longer distances. The shops in the central area maintained their share of visitors, which seemed to be more dependent on the size of the shop than its accessibility.

Garton's (1977) attitude survey in Barnsley showed that prior to pedestrianisation, 87% of pedestrians thought there was a serious conflict between the needs of the pedestrian and those of the motorist, and 82% thought that pedestrianisation would improve the quality of city life. After pedestrianisation attitudes towards the shopping street were seen to have improved still further. Findings of the Barnsley local plan revealed that bus passengers had to walk further than car users following pedestrianisation: 25% of car users parked with 100m of their first destination, while this figure was only 5% for bus users. Further research in Barnsley (May, 1982) has looked in more detail at the trade-off between accessibility and the improved environment in newly pedestrianised streets. Attitude surveys of the use of buses in pedestrian streets found that most people welcomed the removal of the buses and although this involved longer walking distances, many respondents felt that their accessibility had been enhanced. This may be due to the improved walking environment. TEST (1981) have examined the use of buses in pedestrian streets and conclude that it is one way of ensuring that access is equal for all users.

Stewart's (1979) research on user response to pedestrianised streets in Birmingham, Bristol, Bolton and Hereford showed that 83% of respondents preferred to shop in a street without traffic. Of those familiar with the streets before pedestrianisation, over 50% thought that their bus stop or car park was the same distance away. Car drivers were more likely to think that they had to walk further, but only 14% of all respondents thought that the distance was too far.

Pedestrian flows are also used as an indicator of a successful scheme and they normally increase where pedestrianisation is implemented. Much research has been undertaken on the subject of pedestrian movement (Copley and Mayer 1975, Seneviratine and Morall 1985) and a variety of other street conditions are thought to influence pedestrian flows, densities, speeds and distance travelled. Hoel (1968) found that the travel speed of walkers reduced in hotter weather, that people walked faster in the morning and that men walked faster than women. Pavement surface, obstructions, vehicular traffic on the pavement and building type did not appear to affect travel rates. Older (1968) found that speed reduced as the density of pedestrians on the pavement increased. Oeding (1963) found that there were significant variations in speed according to trip purpose and concluded that motivation for the trip was a strong positive factor influencing speed. Gradient also influences walking speed (Bruce 1965). Average trip lengths for males are higher than for women (Pushkarev and Zupan 1975). Lovemark's (1972) work on trip lengths shows that they increase if the pedestrian environment is more pleasant and this could have particular significance when a street is pedestrianised.

This review has examined a selection of the many examples of research into pedestrianisation. It is clear that the introduction of such a scheme has an impact on many aspects of the city. The current research is concerned with three key issues; the accessibility of the city centre, the improvements in the environment of the city centre and how city centre users accept the trade-off between these two, demonstrated by their attitudes and behaviour.

Accessibility is important both for retailers in the pedestrianised zone and for the users who want to visit or shop in the area. Retailers are concerned about changes in access for delivery vehicles but worry more about any reduction in the accessibility of the centre for the shoppers since this might cause a decrease in the numbers visiting the city centre and a consequent loss of trade. The city-centre users are concerned about any changes in the accessibility to the zone since this could involve longer walking distances and mean that a modification of shopping behaviour is required.

The experience of pedestrianisation in Plymouth reflects these fears and the next chapter, which details the development of the city centre, illustrates the opposition to pedestrianisation in more detail.

CHAPTER THREE

THE DEVELOPMENT OF PLYMOUTH'S CITY CENTRE

This chapter will trace the development of the design of Plymouth's city centre from the post-war reconstruction plan to the present day pedestrianisation scheme introduced in February 1987.

3.1. The 'Abercrombie' Plan

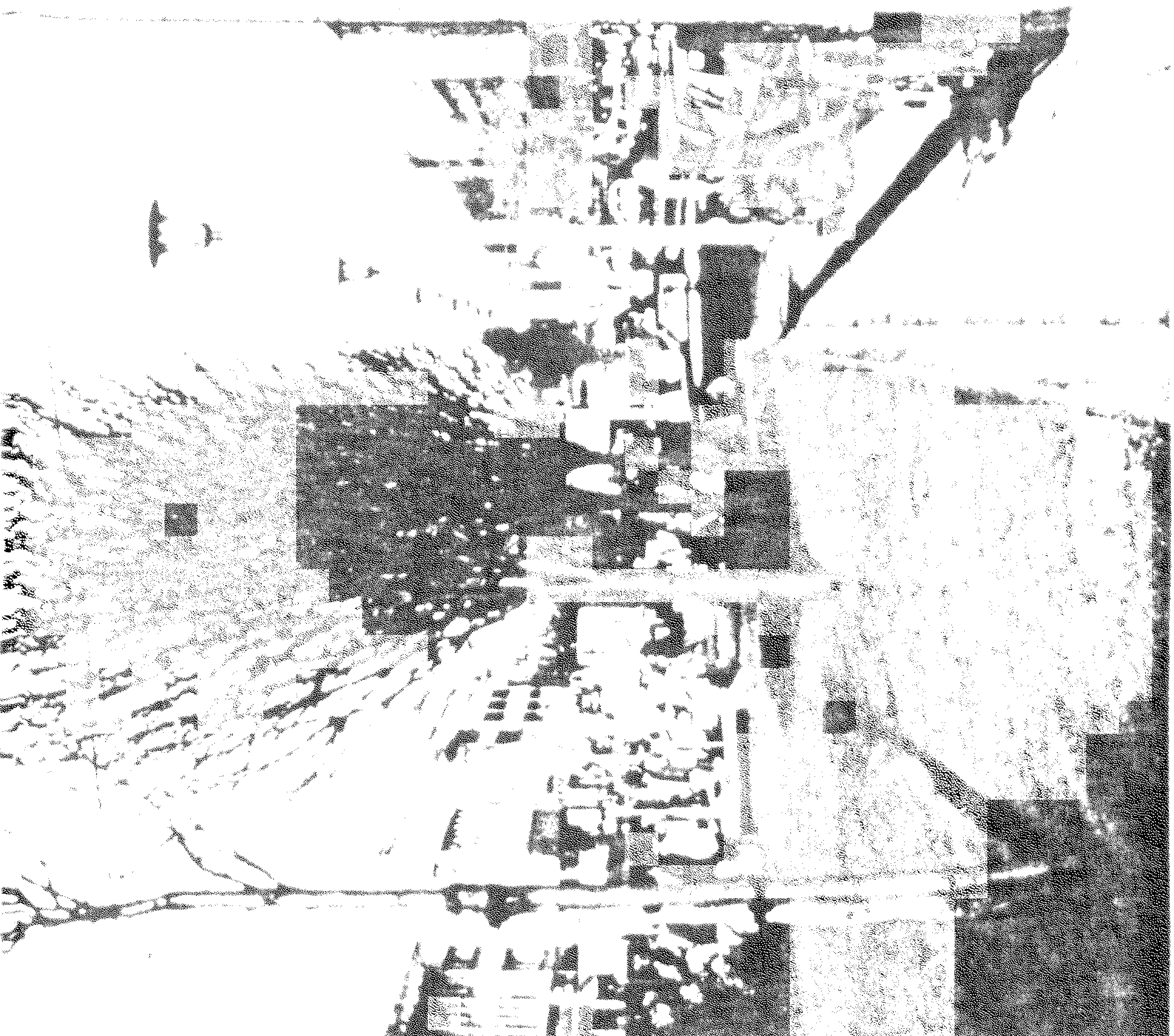
The city of Plymouth suffered severe bomb damage during the war which destroyed many of the the buildings in the city centre and reduced 114 acres of the town to wasteland (Goodridge 1983). The need to rebuild the city was seen as an opportunity to create a new and better environment which would eradicate past problems of poor living conditions and city centre traffic congestion. In order to achieve this, a far-ranging and comprehensive plan was conceived which would pay particular attention to rebuilding housing stock, creating more open spaces and re-establishing the commercial basis of the city. The 'Plan for Plymouth' (1943) was drawn up by the City Engineer and Surveyor, Mr J.Paton Watson, together with Professor Abercrombie, President of the Town Planning Institute, whose assistance was invited by the Council and Lord Astor, the Mayor of the city.

The radical design of the new city centre was crucial to the plan, symbolising the resurrection and hope of the city. The planners felt that this would be achieved by constructing an aesthetically pleasing and functionally efficient shopping environment that would quickly re-establish the commercial base of the city (Chalkley 1983).The plan also intended to remedy the pre-war problems of congestion and overcrowding and the new road layout ignored the old street patterns with many remaining buildings being pulled down in order to acommodate it. The new city centre was therefore planned as if on a completely new site.

Work began on re-constructing the city centre in 1947, and although there were minor changes in the design, most of the main features remained. The resulting city centre consists of a series of wide streets running from east to west, with the focal street, Armada Way bissecting them from north to south (Fig 3.1). The central area is surrounded by a ring road intended to divert through traffic away from the shopping area. The streets themselves are very wide; Armada Way is 150 ft. (46m) wide when measured from building to building and the east-west streets are 70 - 80 ft. (21 - 24m) wide. The streets accommodate purpose-built shops and offices, and until recently on-street meters lined most of the streets (Fig 3.2). The overall impression, before pedestrianisation in 1987, was that of a city designed principally with the growing number of motorists in mind. The plan did pay some consideration to the pedestrian and Armada Way was envisaged as a 'no road or traffic approach'. The content of the

Figure 3.1 Plymouth City Centre

(Ordnance Survey)



plan clearly showed that priority for the car user was paramount in the planners' mind.

> 'The use of surface crossings by pedestrians is always obstructive to the traffic flow, but in the absence of legislation compelling their use, it is realised that the public would only use subways or bridges if they were so constructed as to make it easier to cross by these means...'
>
> Nevertheless, at very heavily trafficked points, subways may have to be constructed with safety railings, or other devices provided for a sufficient distance on either side, to inconvenience, and so compel the pedestrian to use them. Similarly we suggest that the raised verges should be used to deter pedestrians crossing the roadway except at predetermined surface crossings. Pedestrians must accept their full responsibility, and if freedom of the road is to be enjoyed then, as with all rights, some discipline is necessary, or chaos ensues.' (Plan For Plymouth 1943).

This bias towards the motorist was recognised in Buchanan's 'Traffic in Towns' (1963), a report itself heavily criticised for being car-orientated (Hillman 1983). This report was commisioned by the Minister of Transport to study the problems posed by the rapid growth of motor traffic. The report looked at various towns and cities including Plymouth where it examined one of the east-west streets (Cornwall Street, Fig 3.1) and found that accessibility for vehicular traffic was fairly good; the wide roads could accommodate both the shopping traffic and the delivery traffic requiring access to the rear service courts. For pedestrians, however, the conditions were regarded as unsatisfactory. Crossing the roads was found to be particularly difficult. The report concluded that:

'the design has not, in the event, turned out for the best. Were it possible to start afresh there seems no doubt that much greater regard would be paid to pedestrian movement, and a different kind of design would emerge as a consequence.'

3.2. The History Of Pedestrianisation In Plymouth

Despite the criticisms of the 'Abercrombie plan', Plymouth continued to be regarded as a model of modern city planning. Possibly because of the wide streets and pavements, and the ring road minimising through traffic, Plymouth absorbed the growth of vehicular traffic and the problems of congestion were not felt so acutely as in most other towns and cities. However, by the early seventies, congestion at peak periods suggested that the city centre was approaching saturation levels and it was at this time that interest in pedestrianisation was voiced (Junior Chamber of Commerce 1972). Legislation allowing for the street conversions was passed at this time (Elkington et al 1976) and other towns and cities in the U.K. were beginning to experiment with pedestrianisation (Roberts 1981). The first detailed proposal for

Plymouth was in 1972, and was followed by a series of plans recommending the introduction of a variety of traffic-free pedestrian areas (Table 3.1).

Table 3.1 Proposed Pedestrianisation Schemes, 1972-1986

1972	The Port of Plymouth Junior Chamber of Commerce Study
1973	Plymouth and Environs Transportation Study (Plymouth City Council)
1981	Port of Plymouth Junior Chamber of Commerce Proposal
1982	Devon County Council Proposal
1983	City of Plymouth Draft Local Plan (Plymouth City Council)
1986	Plymouth City Centre Proposed Pedestrianisation Scheme (Devon County Council and Plymouth City Council)

3.2.1 The Port of Plymouth Junior Chamber of Commerce Study 1972

The proposal (undertaken on the Chamber's own initiative) suggested the introduction of a traffic-free precinct in the city centre (Junior

Chamber 1972). The proposal sought to make the city centre a much safer and pleasanter shopping environment that would enhance its reputation as a civilised and unrivalled modern city centre. The proposal had the proviso that any action taken in banning the car from the city centre would only be practical if adequate car parking was provided around the traffic-free zones.

The plan itself recognised the importance of Armada Way as the main avenue of the city and suggested that, by allowing pedestrians to walk uninterrupted along its length, a more carefree and troublefree shopping environment would be created. The proposal therefore included a traffic-free New George Street, Old Town Street, Cornwall Street, Mayflower Street, and Armada Way. Strategic car parks would be located around the perimeter of the precinct and Royal Parade would be limited to public transport only, which would serve the car parks (Fig.3.3).

In addition to these restrictions on traffic, the plan also incorporated some ambitious design features that would have enhanced the shopping experience. They included street canopies over the main streets, and travelling pavements that would unify the east and west of the city centre. Additional car parking sites were also recommended. Access for servicing vehicles would be permitted at certain times of the day and access roads to the rear courts would be provided. The proposal there-fore tackled the problem of creating an improved shopping environment while maintaining the accessibility of the city centre for both the car users and the servicing vehicles.

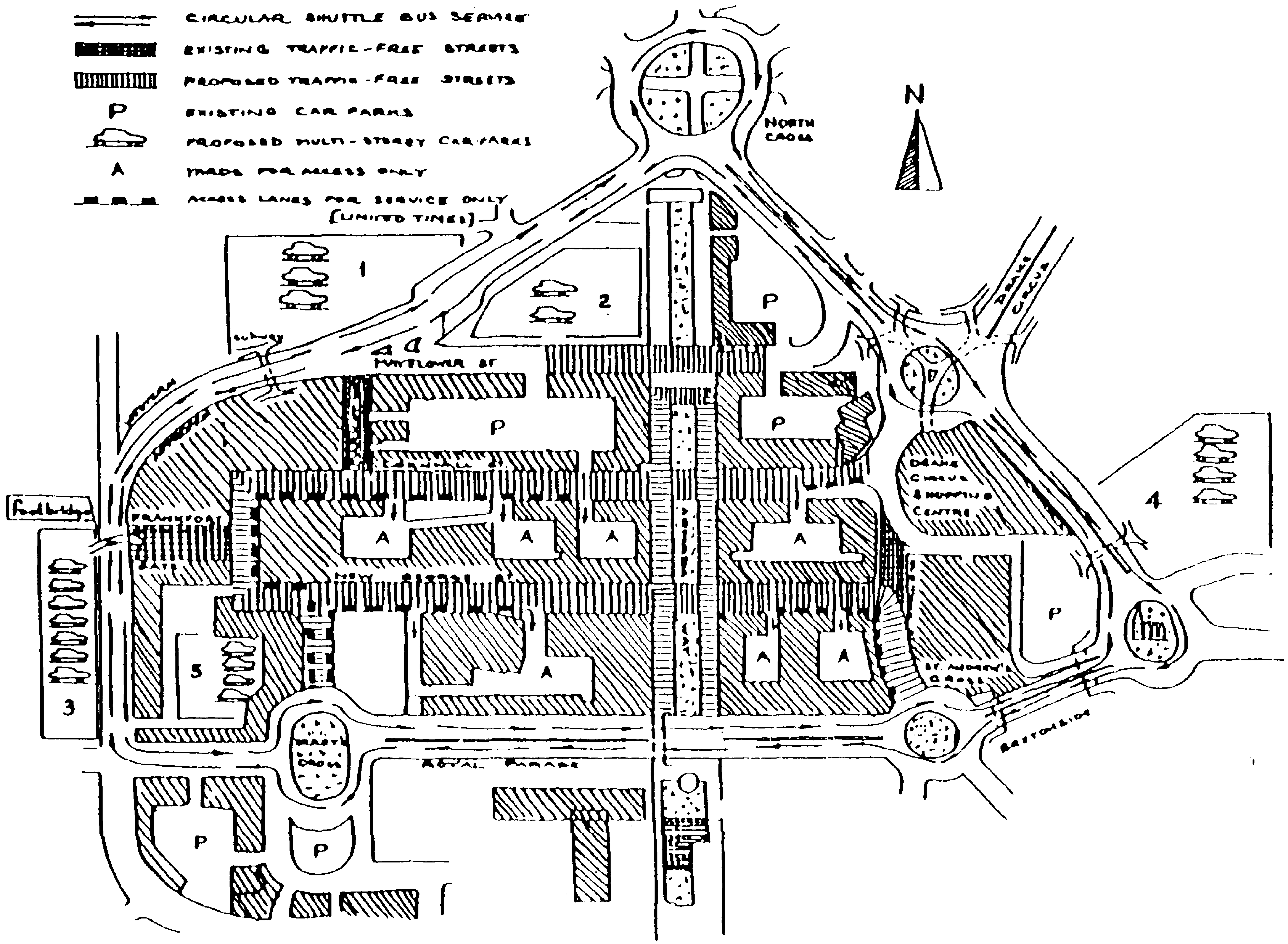


FIGURE 3.3 Proposed Pedestrianisation Scheme 1972
(Source: Junior Chamber of Commerce
Reproduced with permission)

An experimental scheme was recommended together with a detailed phased introduction for the entire scheme, but it was not taken up by the local authorities mainly because at that time Plymouth city centre had few competing retail centres and such a lavish plan was deemed unnecessary.
(Personal correspondence, City Council 1988).

3.2.2. The Plymouth and Environs Transportation Study, 1973

This was produced on behalf of the local authorities and aimed to present an overall transportation plan for the Plymouth area for 1986.

The study included a proposal for the pedestrianisation of some parts of the city centre. The main feature of the proposal was, like the Junior Chamber's, the creation of a traffic-free Armada Way, but this time extending it as far as Notte Street in the south. Parts of New George Street and Cornwall Street on either side of Armada Way were also to be restricted to pedestrians so that the only cross-traffic would occur at Royal Parade, which would be served by an underpass (Fig.3.4). Additional features of the scheme were:

1. the pedestrianisation of the north side of New George Street to link up with Old Town Street and existing traffic-free precinct at the Drake Circus shopping centre.

FIGURE 3.4

Plymouth City Centre

PROPOSED PEDESTRIANISATION SCHEME

PLYMOUTH AND ENVIRONS TRANSPORTATION STUDY
1973

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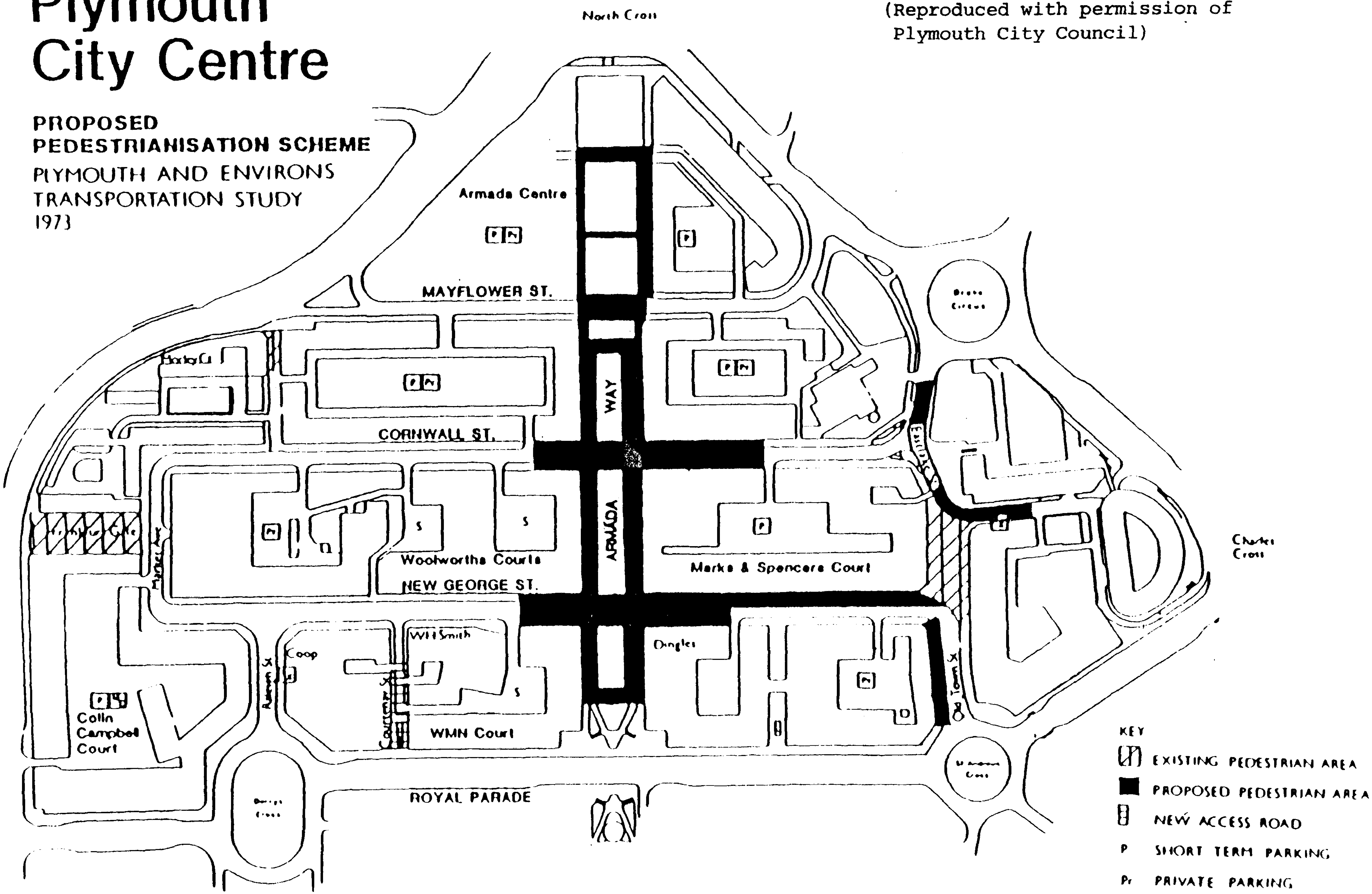


2. the pedestrianisation of Eastlake Street to link up with Old Town Street and the Drake Circus shopping centre.

3. the pedestrianisation of the western carriageway of Old Town Street from St. Andrew's Cross to New George Street.

Provision was made for access to residential flats in the eastern side of the city and access for delivery vehicles was to be maintained. The on-street parking facilities would all have been removed and the car parks behind Woolworths and the Western Morning News were to be given over to servicing vehicles. The introduction of one-way traffic systems was also envisaged. The scheme would have meant the loss of 418 parking meters and 109 parking spaces from the parking stock of 5,000 within 500 metres of Armada Way. The cost in 1973 prices was estimated at £100,000, but by 1981 the cost had risen to £450,000 to £500,000. The construction of a multi-storey car park would have increased this estimate by £1.5 million. The proposal was not given high priority in the study and as a result was not introduced.

3.2.3. The Port of Plymouth Junior Chamber of Commerce Proposal, 1981

Nine years after their previous recommendations, the Junior Chamber of Commerce put forward a three phase plan for a traffic-free area in the city centre which would largely have been the same as that suggested in 1972 (Figs. 3.5 and 3.6).

FIGURE 3.5 The smaller proposed pedestrianisation scheme
(Source: Junior Chamber of Commerce, phase 1(a)) 1981

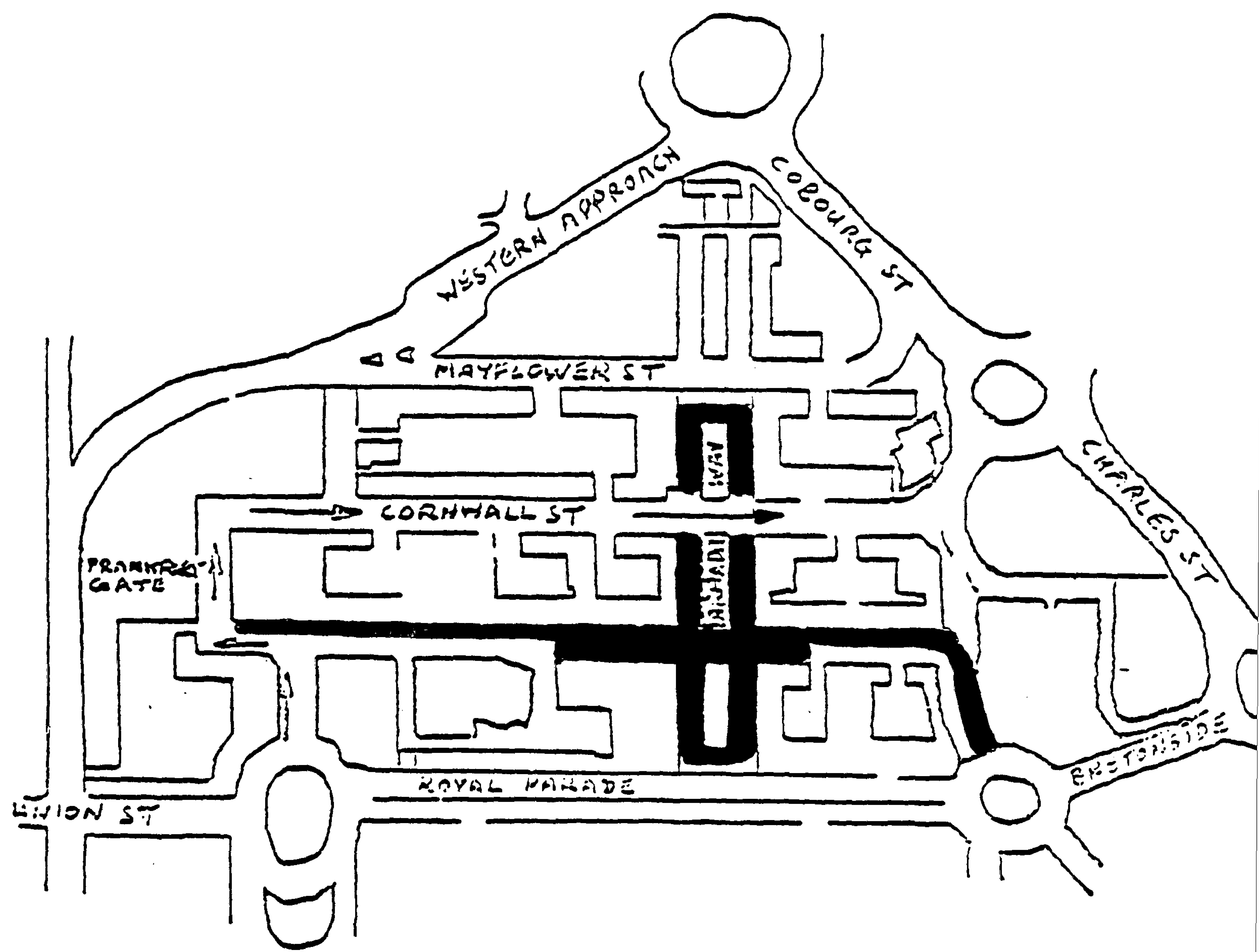
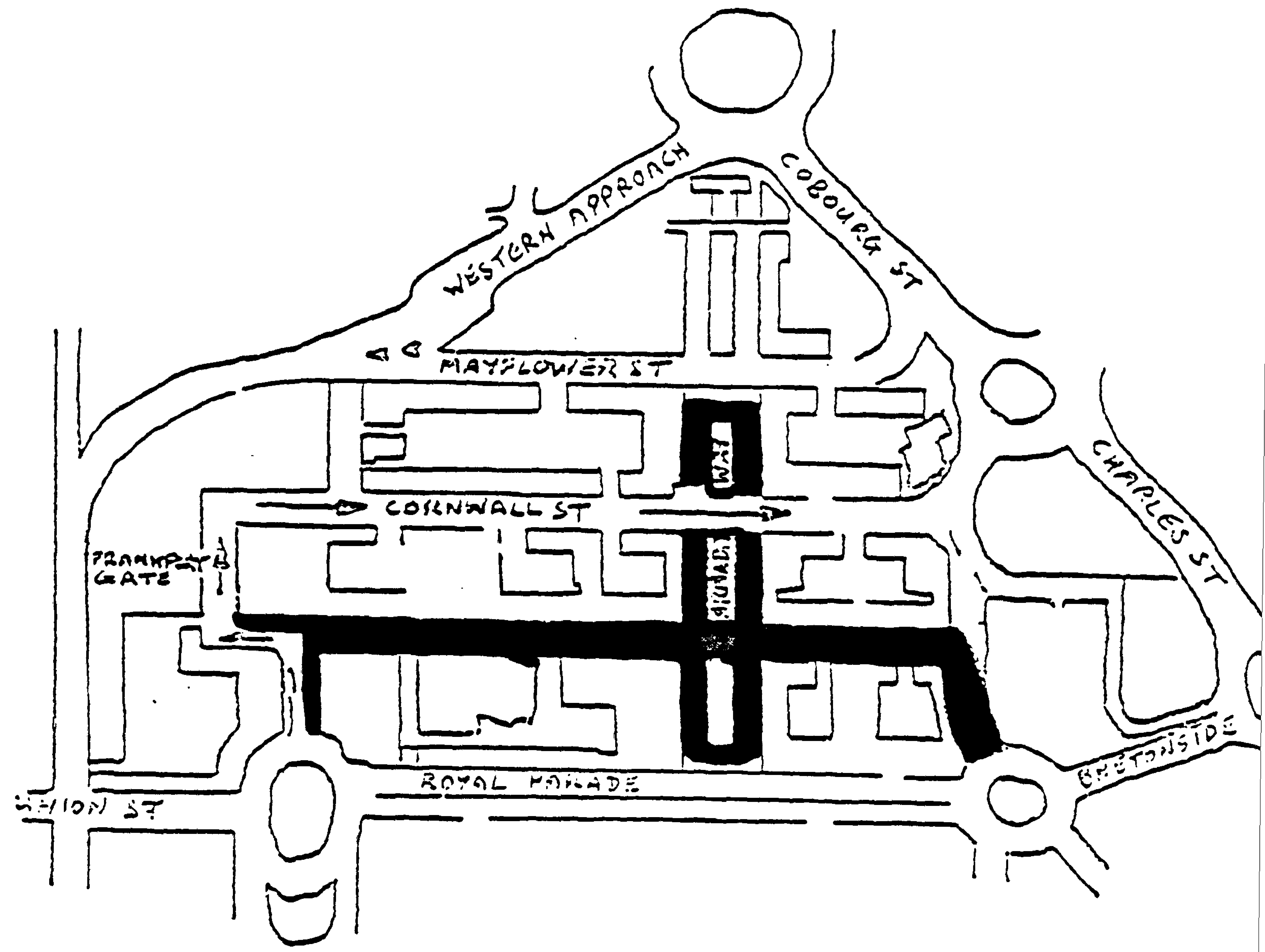


FIGURE 3.6 The larger proposed pedestrianisation scheme
(Source: Junior Chamber of Commerce, Phase 1(a) and 1(b)) 1981



Phase 1 would have banned vehicular traffic from Armada Way up to Mayflower Street, the eastern side of Old Town Street, the whole of the northern side of New George Street and the southern side from the eastern side of the access road at the back of the Western Morning news offices to the western side of the access road at the back of Dingles (Fig 3).All traffic except servicing vehicles, staff vehicles and disabled vehicles would have been banned from the western side of Old Town Street, the eastern side of Raleigh Street and the southern side of New George Street up to the access road behind Dingles and from the junction with Raleigh Street as far as the eastern access road behind the Western Morning News.A one-way traffic flow was envisaged from Derry's Cross northwards up Raleigh Street and Market Avenue and eastwards up Cornwall Street.

The Chamber proposed that the scheme should be constantly assessed and monitored by surveys. If the first phase was successful, then phase 2 would be implemented. Phase 2 would transfer the surplus parking meters to the southern side of Cornwall Street and the western side of Market Avenue, where a pelican crossing would be provided opposite Frankfurt Gate. The traffic-free areas created in Phase 1 would be provided with pedestrian facilities such as seats, trees and kiosks. Phase 3 would follow which would completely ban traffic from New George Street, Cornwall Street, Armada Way, Old Town Street and Raleigh Street (Fig 3.6).

The proposal would have meant that 250 parking meters would have been lost as well as 35 from the Western Morning news car park and the chamber suggested several sites for multi-storey car parks. The Chamber did not suggest many of the ambitious design features mentioned in their earlier report. No action was taken at this stage by the local authorities although their own proposal a year later incorporated some of the recommendations.

3.2.4 Devon County Council Proposal, 1982

The Devon County Council's Engineer's Department put forward an experimental plan much the same as that outlined in Phase 1 of the previous Junior Chamber of Commerce proposal, except that Armada Way would not have been pedestrianised north of Cornwall Street (Fig 3.7). Traffic would have been banned from the southern side of New George Street between Raleigh Street and the Western Morning News access road. Old Town Street and the Dingle's access road would also be traffic-free. Access for service and disabled vehicles was to be maintained. Although some 217 parking meters were lost from the pedestrianised street, 47 were to be relocated in Cornwall Street and Eastlake Street, and this, together with the growth in the number of parking spaces since 1973, would, it was argued, constitute a net gain of 1122 city centre parking spaces since 1973. Provision was also made for the introduction of additional taxi ranks.

The estimated cost of the experimental scheme was £20,000. The proposal envisaged the scheme's introduction in a series of six monthly periods up to the summer of 1983. Although there were no real

FIGURE 3.7

Plymouth City Centre

PROPOSED PEDESTRIANISATION SCHEME
DEVON COUNTY COUNCIL
1982

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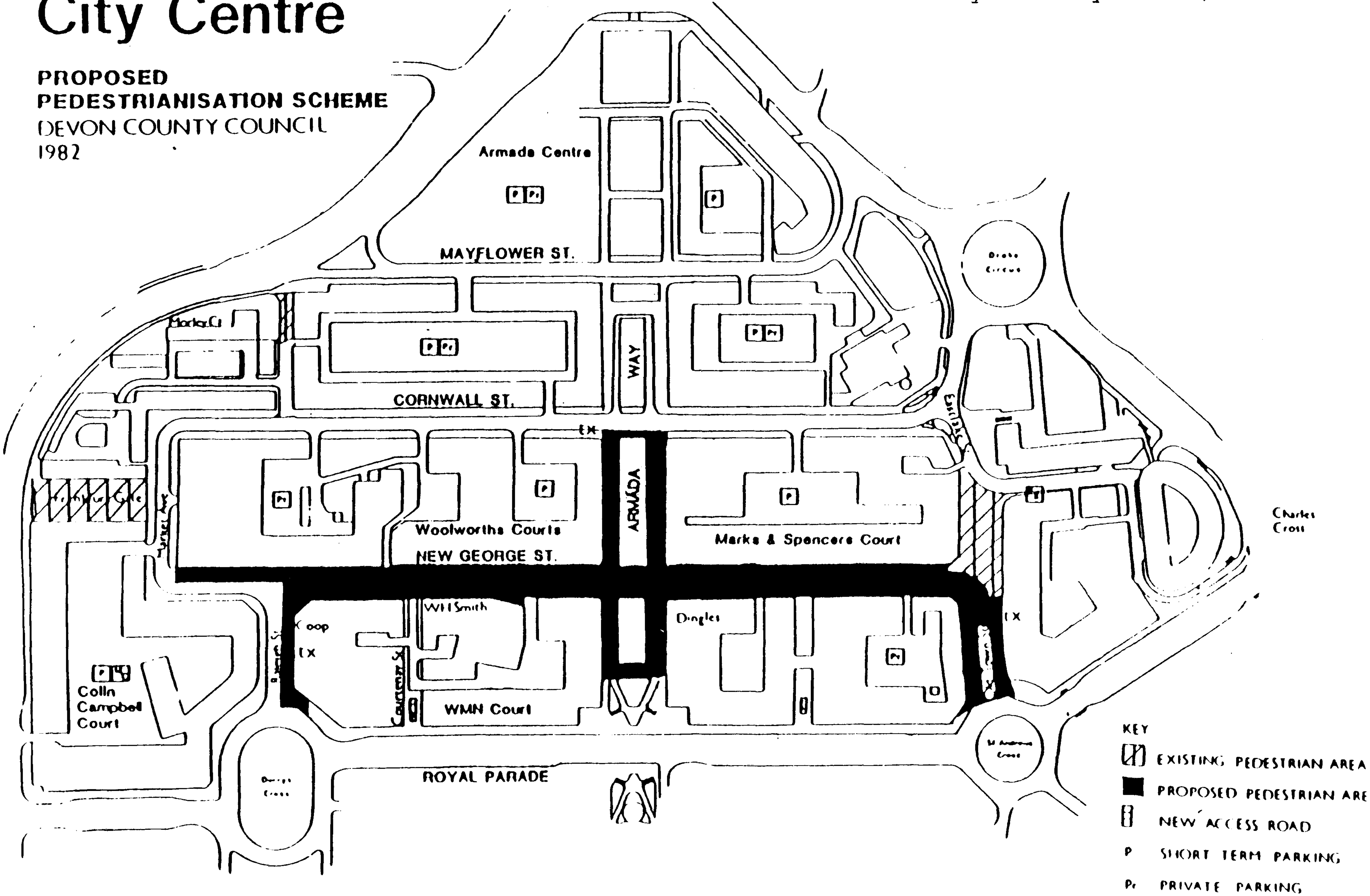

objections to the plan, there was also no real enthusiasm for it either and again the proposals were not implemented. (Personal correspondence 1987).

3.2.5. City of Plymouth Draft Local Plan 1983

The plan recommended the introduction of a pedestrianisation scheme in the city centre. The plan was largely the same as that suggested in 1973 by the Plymouth and Environs Transportation Study, but details of the scheme's introduction were not included pending the results of surveys and studies that were to be conducted. This plan initiated the first positive steps towards the introduction of the scheme.

3.2.6. Plymouth City Centre Proposed Pedestrianisation Scheme, 1986

During 1984 (following the proposals of 1983) both the County and City Councils undertook a series of surveys relating to pedestrianisation and covering such topics as vehicular/pedestrian conflict, economic effects, car parking usage and pollution levels. A survey of pedestrian attitudes had already been completed by students at the Plymouth Polytechnic, under the supervision of staff in the Shipping and Transport Department. Various groups and organisations were also consulted about their views. The results of these studies were used as a framework for planning a scheme which was finalised in early 1986 and was then used as a basis for a public consultation study (Fig 3.8).

The scheme proposed the complete pedestrianisation of Armada Way, from above Mayflower Street to Royal Parade. Sections of Cornwall Street and New George Street were also included so that pedestrian/vehicular conflict would be minimised around this central core. Cornwall Street was to be traffic-free from the western side of the entrance to Marks and Spencer's court car park to the eastern side of the entrance to the car park behind Woolworths.

New George Street was to be wholly pedestrianised from the eastern edge of the Western Morning News car park to the western side of the entrance to Dingles rear court. The northern carriageway was also to be traffic-free in the western direction as far as Market Avenue, with a break at its junction with Raleigh Street (to allow for turning) and in the eastern direction as far as Old Town Street. Additionally, the western carriageway of Old Town Street was to be traffic-free.

The public consultation period during March 1986 was largely successful in that most of the organisations consulted and a clear majority of the general public were in favour of the outlined scheme (Report of Area Engineer April 1986). Meetings were held with 22 groups and organisations that would be affected by the scheme. These included both the Senior and Junior Chambers of Commerce, public transport companies, car associations, emergency services, service companies, and some groups of traders. A few shops and businesses

FIGURE 3.8

Plymouth City Centre

PROPOSED PEDESTRIANISATION SCHEME
PROPOSAL FOR CONSULTATION
1986

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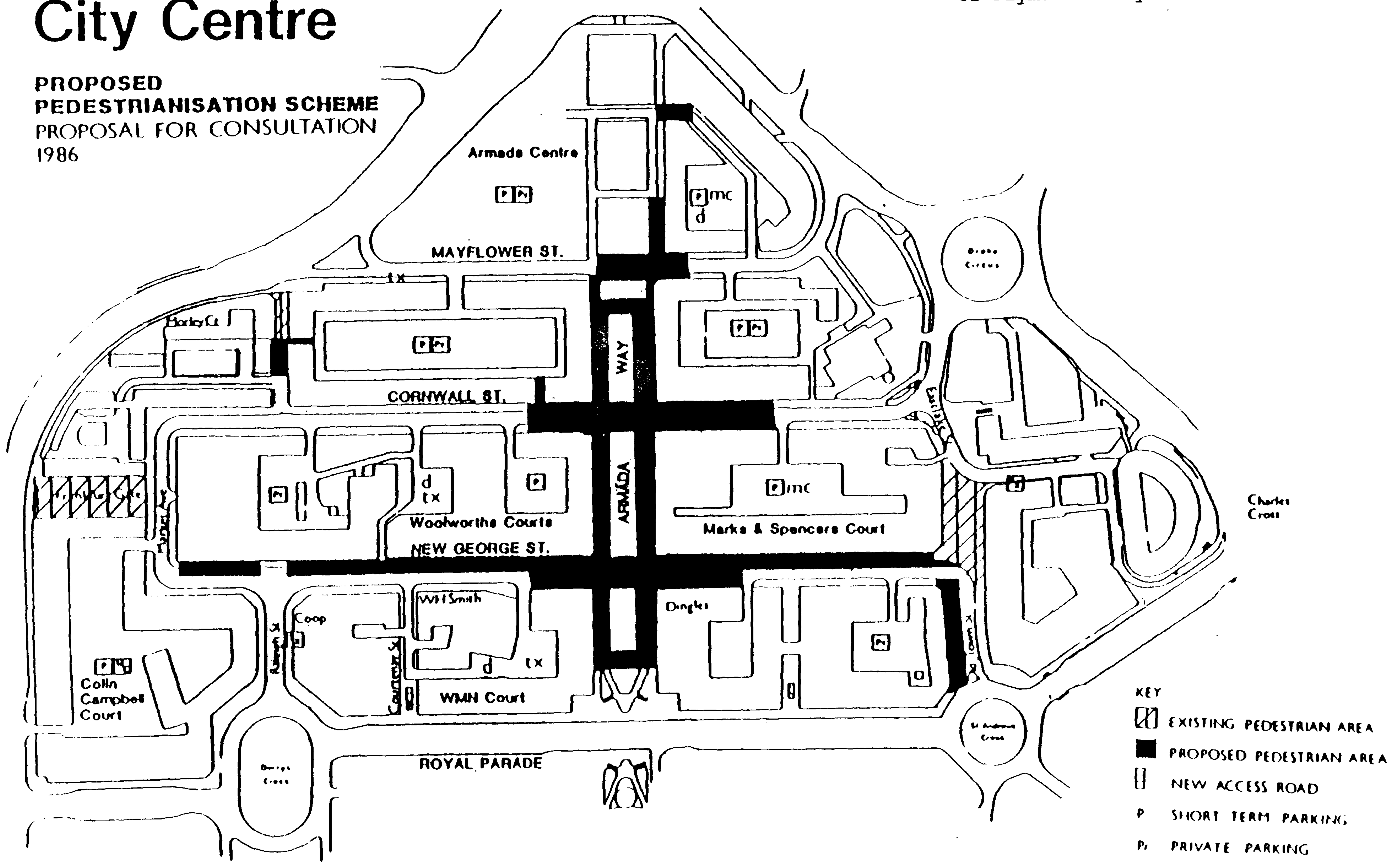


suggested a number of changes and these resulted in several amendments to the scheme:

1. The creation of a new traffic entry between Courtenay Street and Royal Parade.

   The new junction would meet the requests of W.H. Smiths and the Co-op and as the Western Morning News car park was to be restricted to disabled and servicing vehicles, only a limited amount of traffic should have to use the road.

2. The extension of the area of pedestrianisation on New George Street. In the western direction total pedestrianisation would be extended as far as Raleigh Street. The proposed new junction (above) makes this possible as only one vehicle (delivering newsprint to Western Morning News) requires the use of the pedestrianised area. The eastern end of New George Street is also now to be fully pedestrianised. Although servicing vehicles will be allowed through this area, it is felt that detailed design clearly identifying the difference between pedestrian and vehicular areas should minimise any potential conflict.

3. The deletion of Mayflower Street from the proposal. Many long-established retailers were opposed to this area of pedestrianisation, partly because of potential access problems to and from Sainsbury' car parks and also because of fears about

loss of trade. These views resulted in the decision to omit Mayflower Street from the scheme at this stage. The situation, however, will remain under review.

4. The postponement of implementation until January 1987. Many traders felt that October was a bad month to initiate the scheme as this was the beginning of the run up to Christmas. The City Council feared that inadequate parking might also be a problem so implementation was re-scheduled for January 1987, after the post-Christmas sales.

The final plan is shown in Figure 3.9.

3.3. <u>Facilities Within The Pedestrianised Zone</u> (Area Engineers Report 1986).

Parking

In 1986 there were 2,683 short stay parking spaces in the city centre, 422 parking meters and 1,952 long stay or commuter places. Under the scheme nearly all the meters were removed and many of the short-stay facilities located in the rear courtyards disappeared. However new facilities were provided at the new Western Approach car park on its completion in 1988. In the mean time, some long- term spaces were changed to short-term parking and the disparity was reduced. There was still concern that there was inadequate parking facilities at certain times of the year (e.g Christmas), but surveys have suggested

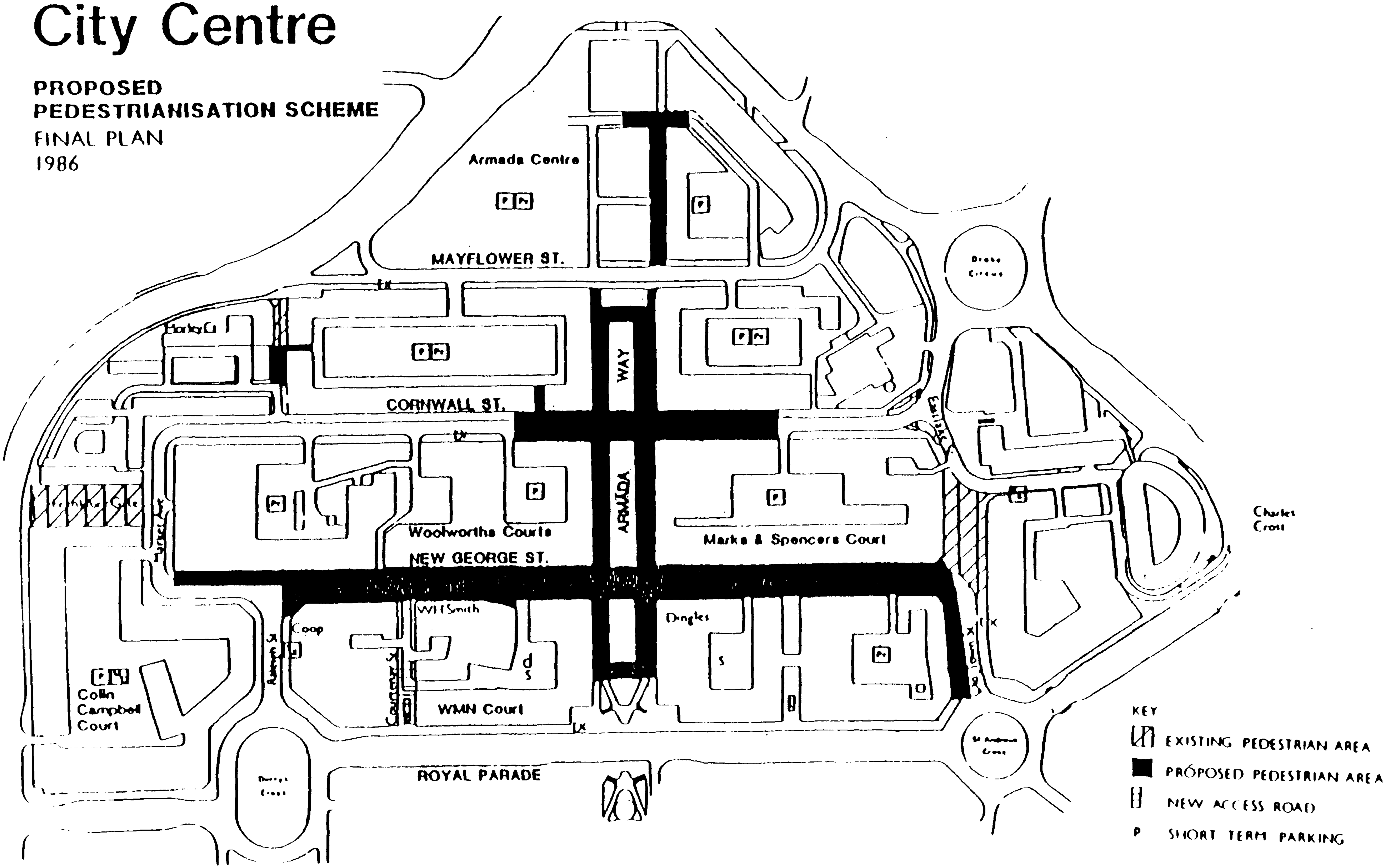
FIGURE 3.9

Plymouth City Centre

PROPOSED PEDESTRIANISATION SCHEME

FINAL PLAN
1986

(Reproduced with permission of Plymouth City Council)



that facilities are sufficient to cope with the demand at other times. Alternative peripheral sites for more parking facilities are constantly under review and park and ride facilities have been introduced at peak shopping seasons.

Disabled Parking and Access

It was felt that the loss of the on-street meters would particularly disadvantage the disabled drivers. However, many of the rear courtyards were designated purely for the disabled and servicing vehicles, and this has helped to alleviate the problem. Additionally, some areas of the pedestrian zone are accessible to disabled vehicles. The City Council is also currently looking into the possibility of providing some kind of electronically powered trolley that would facilitate access within the pedestrianised core.

Taxis

Taxi operators were concerned about the loss of the ranks outside Dingles and in Old Town Street. These were to have been replaced by ranks in the rear courtyards but this was considered unacceptable by the operators as they would have been concealed from their potential customers. It was consequently decided to retain the rank in Old Town Street but integrate it with the traffic-free zone, and to provide more ranks in Cornwall Street and Royal Parade. The rank in Mayflower Street was also extended.

Landscaping

Landscaping began immediately after the traffic orders were imposed, but it took until early 1990 to complete all the facilities. (Tomorrows Plymouth 1987).

Finance

The cost of pedestrianisation was be over £1 million. The County Council is also spending £12,000 a year over a five year period on improving the appearance, safety and security of the car parks.

3.4. The Reasons For The Late Pedestrianisation Of Plymouth's City Centre.

Although interest in some kind of pedestrianisation scheme for Plymouth was regularly expressed, none of the recommendations were taken any further, until the plan proposed in 1986. Undoubtedly there were financial and political reasons contributing to this lack of initiative, but it is more likely that there was no real incentive within the local authority for the introduction of such schemes.

In the rest of the country pedestrianisation was widely being adopted but mainly in historical towns and cities whose ancient street patterns were unable to support the growing number of motorists. Traffic restrictions were increasingly being used in order to preserve the historical image of the cities and to enhance the safety of pedestrians (Roberts 1981). Plymouth's city centre had been built as an example of modern city planning and although dating back to the 1940s, it was still regarded as a new shopping centre with modern architecture and design features. The street layout, of broad avenues and wide pavements portrayed an image of open spaces, and being designed primarily with the car in mind, they were able to cope reasonably well with the increasing amount of traffic (Chalkley 1983).

Other cities introducing pedestrian areas were motivated by the need to revitalise run-down inner city areas or to counter competition from newly developing out-of-town shopping centres. Plymouth city centre was not in any way run-down or in urgent need of revitalisation and the threat from out-of-town shopping centres came late to south west England. In 1986, the south west had only 30 superstores, less than any where else in the country except East Anglia which had 13 (MSI 1987).

The other environmental initiative being introduced in city centres throughout the country was the purpose-built pedestrian enclave. These have been around for some considerable time, but few new ones had been constructed until the late 1960's and 70's when modern shopping centres were beginning to incorporate them (Roberts 1981, Mackeith 1986). Such enclaves were not transferable to Plymouth's large set design, although there has been limited development of this kind in certain areas of the city, e.g. The Drake Circus precinct in 1971 and the Armada Centre in 1986.

Plymouth's modern, car orientated city centre therefore did not typify the circumstances when pedestrianisation was applicable and this view probably contributed to the delay in implementation. There is, however, no evidence to suggest that the local authorities were opposed to pedestrianisation, indeed the above list of proposals suggests that there was great interest in the idea. However, there was no strong advocate for pedestrianisation within the County or City Councils and this together with the factors listed above meant that no real urgency was attached to the proposals.

In 1986 pedestrianisation was considered seriously and the implementation of such a scheme was given high priority by both Devon County Council and Plymouth City Council. A plan was conceived that was not only the largest of all except one of the previous proposals (the 1972 Junior Chamber's proposal), but which was also to be implemented without an experimental period. The scheme was to be introduced without delay and before replacement parking facilities could be built. The need for both a trial period and plentiful parking spaces were stressed by all previous proposals but these recommendations were ignored in the haste to implement the scheme. The sudden enthusiasm for the introduction of pedestrianisation in 1986 was probably due to a number of factors.

The City Engineer and the City Planning Officer were both strong advocates of pedestrianisation. The City Engineer had previously been involved with successful pedestrianisation schemes in Leeds and

Wakefield and the Planning Officer's report 'Tomorrow's Plymouth' reflects his enthusiasm for traffic-free areas.

Several major traders in Plymouth city centre were also very keen on the introduction of a pedestrianisation scheme. Some of them were refusing to expand their businesses, while others were looking elsewhere at sites for potential development. Out-of-town shopping centres were also on the increase: Tesco's alone had recently built two superstores in Plymouth's immediate catchment area, and furniture and DIY stores, all with plentiful parking, were beginning to threaten the commercial supremacy of the city centre. The City Engineer, speaking in defence of the scheme, stated that:

> In this business there is no such thing as standing still: you are either ahead or falling behind. Plymouth has a name for aggressive development and marketing; good communications, clean environment, skilled workforce and low wage rates. We are very good at meeting programmes set down by outside investors. We were very late pedestrianising, one of the last cities in the country.
>
> (Guardian 20.10.87).

Pressure from the major city centre stores together with the enthusiasm of the officers no doubt contributed to the swift implementation of the scheme, but the growing congestion in the city centre and the deteriorating pedestrian environment were fundamental to the decision (Personal Correspondences, City Council 1987).

3.5. The Introduction Of Pedestrianisation

The plan was due to be implemented on January 26th 1987, but a further delay of one week was incurred because of a last minute attempt to get the scheme postponed.These objections were spearheaded by a number of Conservative County Councillors who were concerned primarily with the loss of parking facilities. They had the support of some City councillors, several major city-centre traders as well as a considerable number of smaller retailers in the city. The Junior Chamber of Commerce also refused to support the scheme, their President stating,

> the woeful lack of adequate car parking will, in our opinion, place the success of the scheme in jeopardy.......Failure in this respect will drive the shopping motorist to the ever growing number of out-of-town shopping centres, which have been allowed to proliferate.
>
> (Western Evening Herald, WEH, 14.1.87).

The traders, particularly those running the smaller, specialist shops were not only concerned about the lack of car parking, but were also angry about the lack of consultation between themselves and the planners. The City Centre Business Association claimed that they had only been asked for their opinion on a proposed experimental scheme and that when they heard that the scheme was to be implemented without a trial period, it came 'as a complete shock' (CCBA 1987).

Opposers to pedestrianisation claimed that the scheme was being pushed through by the County Council, against the wishes of the majority of the city inhabitants. Arnold Sayers, a Conservative County Councillor, was one of the leading opponents stated,

> It is obvious that a number of leading traders don't want pedestrianisation yet and why should it be thrust upon an unwilling city by the SDP-controlled county council?
>
> (WEH 16.1.87)

These objections failed to postpone significantly the introduction of the scheme, although County engineers decided to delay implementation for one week. This would allow more time for the County Council to educate the city-centre users on the possible effects of the scheme and get them accustomed to the idea.. An information caravan manned by planning officers was established in the city centre and 30.000 leaflets were distributed to members of the public. Signs informing motorists of available parking facilities were erected around the city, and advertisements detailing car park locations and time durations were placed in local newspapers.

Pedestrianisation was finally introduced in Plymouth city-centre on February 2nd 1987. The scheme was immediately hailed as a success by the City Engineer; there were no traffic problems and ample parking facilities were still available mid-morning (WEH 2.2.88). Some traders, however along with other opponents claimed that the city had been deserted and that the city resembled a 'ghost town' (WEH 2.2.87.) and that it was as 'empty as a western town before a gunfight' (The Raping of Plymouth, The Guardian, 20.10.87., Appendix 1). These criticisms of the scheme continued to be expressed in the days initially following implementation, and some Conservative councillors were calling for the scheme to be abandoned if the first 10 days showed a dramatic fall in trading figures (WEH 3,4.2.87). The Senior Chamber of Commerce, however said that feedback from their members suggested that trading turnover was normal for the time of year, and that more time was needed before a judgement could be made.

A year after pedestrianisation, there were still arguments about whether it had been successful. The City Engineer claimed that it has been a great success and that fears about parking and trading figures had all proved to be unfounded (WEH 2.2.88). Some of the main critics of the scheme were admitting that traffic and parking problems were less severe than anticipated. However, some traders argued that retail turnover had been hit, with some stores reporting a 20% reduction in takings (WEH 2.2.88).A rates enquiry was set up and city-centre retailers, including some large traders such as Dingles, who have always declared to be supporters of pedestrianisation, are demanded a rates rebate, claiming that the disruption of the city has caused an initial reduction in trade(WEH 9.2.88). The controversies surrounding the scheme therefore continued throughout the first year of its history, and the main areas of complaint concerned the lack of car parking and the effect on trade.

This research will examine the impact of pedestrianisation in the city and will look at how the physical changes in the city have affected car borne city-centre users. The two main physical changes in the city have affected accessibility and the city centre environment. The concern of those against pedestrianisation is that city centre users will not accept the trade-off between decreased accessibility and an improved environment, and that they will change their behaviour in a way that is detrimental to the city. Since accessibility is a key area in this research, a more detailed examination of the term, it's definitions and applications is required. The next chapter will therefore review accessibility and its implications for this work.

CHAPTER FOUR

A REVIEW OF THE ACCESSIBILITY LITERATURE

4.1 Introduction

When a city or town centre is pedestrianised there is almost invariably a change in the accessibility to and within the new traffic-free area, which can affect retailers, deliverers, emergency vehicles and the general public's movement to and within the zone. Access is vital for emergency vehicles but is also very important for the general well-being of the retail centre; restricted access can prove inconvenient for delivery vehicles but if easy access is denied to the customers then alternative retail centres with superior access may be preferred at the expense of the newly pedestrianised area.

Accessibility is, therefore, an important concept that needs to be closely considered when planning or appraising a pedestrianisation scheme.

4.2 Defining And Measuring Accessibility

Accessibility has been described as 'one of those common terms that everyone uses until faced with the problem of defining and measuring it' (Gould 1969). The most common definitions derive from the general concept of accessibility 'as some measure of spatial separation of human activities' (Sherman 1974, Morris 1979), and it is widely regarded as a measurement of 'the ease of reaching' (Jones, 1981). More detailed definitions under this umbrella term vary widely but have been categorised into five main sections (Jones 1981):

1. The spatial separation of one point from another;

2. The travel cost of observed or expected trips;

3. The opportunity an individual has at a given location to participate in an activity or set of activities;

4. The average opportunities which the residents of an area possess to participate in an activity;

5. The net benefit people achieve from using the transport and land use system.

Several studies have contributed standardised methods of measuring accessibility. Most of them have their roots in very basic land-use models examining the trade-off between rent and transport costs (Losch 1954, Weber 1929), and then evolving from basic network measures such as associated numbers (Vickerman 1974) and connectivity of networks (Kansky 1963) to become more developed so that they are more relevant to real- world situations (Muraco 1972). The Shimbel measure (Shimbel 1953) considers nodes in relation to all other nodes in a network, i.e.

i = j cij where j is the sum of all nodes in a network and cij is travel cost from i to j. It has been adapted (Ingram 1971) so that, instead of the deterrent effect of travel cost, a function of the travel cost can be used. The network was also divided into zones so that the relative accessibility of one zone to another could be measured, i.e.

Aij = f (cij)

and the integral accessibility (i.e. with regard to all zones) of i would be

Ai = j f (cij)

The problem of measuring accessibility in terms of the combined transport and land-use system has also been tackled (Hansen 1959) and it has become so well established that there is now a class of Hansen-type measures which add together the opportunities available in each zone weighted with the difficulty of reaching that zone, thus the accessibility of zone i would be:

a

Ai = j (Bj/d/ij)

where Bj = the opportunities at zone j, dij = the distance from i to j and a = some constant.

The approach has been taken further to produce what is known as the 'generalised Hansen measure' which considers other ways of measuring the travel deterrent apart from distance, such as bus travel time (Vickerman 1974). Two other major adaptations to the original Hansen index are the 'normalised' and the 'population weighted' indices (Jones 1981). The normalised index is expressed as:

$$Ai = [\ j\ Bj\ f(cij)]\ /\ \ j\ Bj$$

and instead of using the number of opportunities, Bj, in zone j, it uses the proportion of opportunities in the entire study area that zone j possesses. The population weighted index,

$$Ai = Pi\ \ j\ Bj\ f(cij) \quad \text{where } Pi = \text{popn. of zone } i$$

looks at accessibility in terms of the opportunity residents in a certain area have to take part in an activity.

One of the main contributions towards the understanding of accessibility stems from the transport gravity model which derives from Newton's Laws of Gravity. The basic model is expressed as,

$$Iij = MiMj/dij$$

where Iij = the interaction between i and j

Mi and Mj = the masses of i and j

dij = the distance between them

The model has been adapted to measure many kinds of spatial interaction, with the earlier work studying migration flows (Ravenstein 1885, Young 1924). Early research also aimed to identify the trading areas of two competing shopping centres by estimating the volume of trade generated by the population of the intervening space (Reilly 1929). Several studies (Cochrane 1975, Williams 1976) have attempted to develop this model to examine consumer surplus, this being defined as the difference between the sum people have to pay and the sum they would be prepared to pay. The goods in this context are trips and the benefits accrued are the reasons for the travel.

There are several other methods that can be used to measure and study accessibility:

1. Contour measures concentrate on the opportunities reachable in a given travel cost bracket, or can measure the travel cost incurred in reaching a given set of opportunities (Black, 1977).

2. Revealed time measures consider the difference in rents paid for properties that are similar except for their accessibility. This approach also examines any changes in the number and cost of trips made as a result of any changes in either or both the transport and land-use system (Jones 1981).

3. Time space geography (Thrift 1977, Hagerstrand 1975), examines accessibility in terms of the opportunities available to a

person with regard to his or her individual time restraints, and has been used to study the accessibility of people to villages in Norfolk (Mosely et al 1977).

Most studies are adaptations of the Hansen index and the gravity model, often using a combination of techniques so that they can be applied to a particular problem.Hansen originally developed the accessibility index in order to study the relationships between the rate of residential development and access to employment, population and shopping facilities (Hansen 1959). Since then it has been modified and used in its different forms to study a variety of other transport and land use relationships.

Alternative bus services were evaluated using the population weighted index together with the gravity model in the Telford Transportation study, using expected cost as the function of travel cost (Pike et al, 1976). Dalvi and Martin (1976) used Ingram's (1971) integral definition of accessibility in their analysis of accessibility in central London. They applied a normalised Hansen measure for their index of access-ibility that calculated the accessibility of a zone as a function of travel cost to all zones in the travel area and the attractiveness of these zones. Four measures of attractiveness were used: total employment to reflect accessibility to job opportunities and three further indicators of areal attractiveness for non-work trips. The cost of travel was the travel time between the zones. Vickerman (1974) used a generalised Hansen measure to explore the relationship between access-ibility to shops and leisure activities and the number of trips made between them. Robertson (1976) identified the optimum location of major facilities such as schools and hospitals using real road distances and population distribution. Black (1977) examined the effect of access-ibility on trip lengths and found that they became shorter as access-ibility increased. His research incorporated Hansen-type measures but also took the contour approach in order to measure the number of opportunities that could be reached within a given time. Whitbread (1972) adapted the Hansen index to study access to employment opportunities.

Thibeault et al (1973) examined the relationship between accessibility satisfaction, income and residential mobility, concluding that access-ibility, although not a primary reason for moving, was more important to lower income groups who were less likely to be satisfied with their levels of accessibility. Petersen and Worrall (1970) also discovered that the desire for good accessibility was often tempered by the desire to be free from the drawbacks, such as proximity to roads, that enhanced accessibility could mean. Savigear (1967) examined the accessibility of towns using travel cost as a function of distance but also considered the problem of car parking in urban areas. Other studies have used road distance as a measure of travel cost (Robertson, 1976), and Higgs (1976) suggested the use of Konig numbers (the maximum of the distances from one vertex to each of the other vertices in the study area) as an indicator of travel time in central areas. Stegman (1969) used 'time to reach destination' in his research on accessibility and residential location. Breheny (1978), Clark and Rushton (1970) and Sherman et al

(1974) based some of their work on the contour method; the latter examining the percentage of the population located within a given travel time (defined as travel cost) of important metropolitan activities. Clark and Rushton identified the percentage of a rural population located within a certain travel cost of a town with a larger than stated population. The West Yorkshire Transportation studies (1977) also considered accessibility along these lines. Johnston (1966) used a point system in a study of bus services and settlement patterns, where villages where ranked according to the availability of bus services.

Cochrane (1975) studied and developed the role of the gravity model and its applicability in transport studies incorporating the two concepts of consumer surplus and intervening opportunities. Many other researchers have focussed on the gravity model, developing its potential in numerous areas (Wilson 1971, Carruthers 1956, Weibull 1976). Since its early application in defining trade areas (Reilly 1931) the gravity model has been used extensively in the study of spatial shopping models, where it has helped to determine the accessibility of retail centres and the pattern of market areas. Research in this area includes work by Huff (1964), Lakshmanan and Hansen (1965), Wilson (1967), Taylor (1975), Stoufer (1940), Gibson and Pullen (1972), Schiller (1972) and Ghosh (1986). The application of the gravity model in the current research area is discussed in the retail literature review.

Copley (1975) adapted the Hansen indices to study the movement of pedestrians in a newly pedestrianised area, using the index to measure the accessibility of city centre shopping zones before and after the pedestrianisation scheme was introduced. Ness (1969) used a gravity model to predict the journeys to work and lunch hour pedestrian circuits in central Toronto. The model was developed by regarding the termini as transport zones and by dividing the central area into office zones. The generation and attraction rates of the zones and the minimum path walking routes between them constituted the main inputs of the model.Rutherford (1980) also used a gravity model for predicting pedestrian flows. The Main Roads Department, Queensland (1971) used a gravity model in the form of;

$$p = f\left(\frac{(GA)}{(d)}\right)$$

Where p = pedestrian movement by purpose per unit time through defined precincts throughout Queensland.

G = generating zone characteristic

A = attracting zone characteristic

d = distance between generating and attracting zones

This approach was adopted by Scott (1974) who assumed that there was a basic network of streets carrying pedestrian traffic and that certain nodes represented gateways into the network and others represented arrival and departure points. The approach was similar to that used by

Sandahl and Percival (1972). Scott concluded that this method was limited and that more practical pedestrian flow models would use a disaggregate approach. Butler (1978) tried to adapt Scott's work but again found that the generalised approach limited the application of the model. Ballas (1976) had more success when using the gravity model approach to estimate trip generation between zones at the campus at Montana State University and found that 72% of the trips could be predicted. Many other projects have examined the importance of accessibility in an urban environment (Recker and Kostyniuk 1978, Doubleday 1975, Briggs and Jones 1973, Knudsen and Kanafini 1974).

This review has demonstrated that accessibility has attracted a vast amount of interest and research has been conducted in a variety of areas. Many different methods of measuring and evaluating accessibility have been attempted but no one ideal method has been established. Most attempts have involved dividing the study area into zones and the use of a 'generalised' model. These aggregate models study the flows between specified nodes but are unable to identify specific individual behaviour. These methods take the focus away from the individual level and although this increases their transferability to other areas, their accuracy diminishes as a result. One of the main aims of this present research is to examine how pedestrianisation has affected the accessibility of the city centre on two levels; access to the city centre and access within the pedestrianised zone itself and the possible relationship between the two. The research involves the detailed study of car users' parking and shopping behaviour and because of this, a generalised approach to the problem of measuring accessibility would be inappropriate. A disaggregate model is required which would enable these individual behavioural factors to be considered.In order to formulate such a model, a more detailed examination of the factors determining shopping behaviour is required and can be found in Chapter Five.

CHAPTER FIVE

A REVIEW OF CONSUMER BEHAVIOUR LITERATURE

5.1 Spatial Models

Most of the research into consumer behaviour stems from two main areas; economic and marketing research.Economic research is mainly concerned with the spatial location of retail centres and has its origins in central place theory (Christaller 1966, and Losch 1954). This provided a basic framework for normative theories of the spatial organisation of retailing and facilitated the understanding of the size, shape and boundaries of trading areas. Through this work potential customers, competitors and other aspects of the retail environment can be identified. Oppenshaw (1975) identified four main groups of spatial shopping models;

1. Those which relate the volume of retail trade directly to ambient purchasing power.(Lowry 1964, Hill 1965).

2. Those looking at destination choice as a linear function of relative attractiveness and relative accessibility.(Lewis and Bridges 1974).

3. Those based on central place theory.(Berry 1967).

4. Those based on the gravity model.(Reilly 1931,Huff 1964, Lakshmanan and Hansen 1965, Wilson 1967, Taylor 1975, Stouffer 1940, Gibson and Pullen 1972, Schiller 1972, Ghosh 1986).

The latter two methods are the most popular and have been used extensively. They have offered a 'powerful explanation of the spatial distribution of retail facilities and market centres and the pattern and extent of market areas' (Craig, et al 1984).These economics based models are useful for determining the optimum location of new retail stores but are limited in their application in the understanding of consumer behaviour.They can reasonably accurately predict the spatial distribution of shopping trips and associated levels of sales and expenditure. Their emphasis has been on describing the allocation of a person's present and future spending between various competing centres and determining the levels of turnover derived from certain catchment areas. The models are consequently useful for impact studies and sales forecasts. However, for their calibration most of the models use areal zoning methods and the emphasis is placed on these rather than individuals. Additionally, the trips they describe are normally considered to be single-good journeys and consequently do not explain multi-purpose trips (Shephard and Thomas 1980).

Bacon (1984) developed this approach so that a more realistic model could be built by including the frequency with which people shop, their value of time, the number and type of goods and the size of the shopping 'bundle'. However, his research was still concerned with the choice of shopping centre and was limited because it did not account for the marketing aspects (e.g. the style of the shops, the quality of the service) of retail behaviour or consumer behaviour within the chosen centre. He concluded by suggesting five lifestyle stages that could be built into the model that would further explain consumer behaviour, and would establish a link between the economic and marketing aspects of retail research. These were;

1. A newly married couple with both partners working.

2. A newly married couple with only one person working.

3. Families with young children.

4. Families with children of school age.

5. Retired families.

5.2 Behavioural Models

The marketing side of retail research emphasises the behaviour and attitudes of the consumer. Much of the research stems from the theory of 'retail image', which was first defined by Martineau (1958) as 'the way a store is defined in a shopper's mind partly by its functional qualities and partly by an aura of psychological attributes'. This theory has been developed and retail image has been redefined in a number of ways (Doyle and Fenwick 1974, Engel and Blackwell 1982).

However, the most widely accepted definition is that of Kurkel and Berry (1968) who modified Martineau's theory, defining it as 'the total conceptualisation or expected reinforcement that a person associates with shopping at a particular store'. These theories are normally applied to the study of particular stores or shopping destinations. The current research is more concerned with the actual behaviour of people in a shopping centre, in terms of the distance they are prepared to walk, the number of destinations they visit and their shopping intensity.Although research into the psychology of shopping behaviour also tends to be directed to the explanation of consumer store choice, it can be applied to behaviour in particular shopping areas (Bruce 1974).

Brown (1978) identified two groups of factors which influence consumer behaviour; friction factors which make up the costs of patronising a centre and attraction factors which increase the utility of patronising a centre. Research into the psychology of shopping behaviour attempts to categorise shoppers according to their behaviour and suggests that different shoppers are prepared to accept different trade-offs between these two groups of factors. The concept of categorising shopper behaviour is also related to 'store image' discussed earlier.

Stone (1954) was one of the early researchers who used this approach, and categorised shoppers into four groups;

1. The apathetic shopper who wished to minimise the effort of purchasing.

2. The personalising shopper who was concerned mainly with friendly store personel.

3. The ethical shopper who aimed to help the small retailer compete with larger stores.

4. The economic shopper who considered aspects such as price, quality and variety to be most important.

This research was followed up by studies which identified similar categories (Darden and Reynolds 1971, Stephenson and Willet 1969). More recently a study of supermarket patrons identified seven shopper types (Darden and Ashton 1974). These were;

1. Convenient location shoppers (shopped at nearest store).

2. Apathetic shoppers (concerned with variety and competitive price, not bothered about location)

3. Quality shoppers (demanded good quality, fresh goods and were much less concerned with location, variety or cheap prices).

4. Demanding shoppers (extensive browsing, looking for 'specials' and going from store to store, not that concerned with location).

5. Fastidious shoppers (placed cleanliness as most important store attribute).

6. Stamp preferer (placed great emphasis on trading stamps).

7. Stamp hater (repelled by trading stamps).

This work is similar to the lifestyles approach used extensively for marketing stores and products, initiated by Evans (1959) who by analysing an individual's personality, attempted to predict his or her purchasing choice between two types of car. This and later work (Gottlieb 1959, Westfall 1962, Koponen 1960, Massey, Frank and Lodahl 1968) failed to indicate that personality alone was a good indicator of behaviour. However, the lifestyles concept, a broader approach which developed from it, has shown significant success. Lifestyles are defined as

> patterns in which people live and spend time and money. They are a function of consumers' motivation and prior learning, social class, demographics and other variables
>
> (Engel, Blackwell and Miniard 1982).

Lifestyle categories normally result from the application of the AIO concept, which refers to Activities (sometimes Attitudes), Interests and Opinions. AIO statements are normally collected using Likert scales which ask respondents to state the extent to which they agree or disagree with a selection of statements. In order to determine segmentation the results are cross-tabulated with other variables such as age, sex etc. Mitchell (1983) developed the most commonly used groupings of lifestyles called the VALS program. This has three broad categories which then contain more detailed types. They are summarised below.

1. Need-Driven Consumers
   a) Survivors
   b) Sustainers

2. Outer-Directed Consumers
   a) Belongers
   b) Emulators
   c) Achievers

3. Inner-Directed Consumers
   a) I-Am-Me
   b) Experimental
   c) Societally Conscious
   d) Integrated

These approaches are more concerned with individuals than the aforementioned spatial shopping models, but they are still designed to study and predict the decisions people make in choosing either products or stores. Studies which look at how and why people behave at their chosen destination are uncommon but one of the most popular methods involves the use of travel diaries (Bruce and Mann 1977, Daws and McCulloch 1974). Households or individuals are asked to keep a travel diary of their shopping behaviour over a set time period and these are then analysed with the respondent's socio-economic characteristics and other variables taken into account. Although some of these studies observe patterns of behaviour within shopping areas, most, like previous methods discussed, are concerned with destination choice.

5.3 Shopper Movement Studies

Research specifically looking at shopping movement patterns dates back to the sixties (eg Boul 1963) but little recent work has been conducted in this field, mainly because of the practical difficulties of recording shopping behaviour (Brown 1988). The Chichester study (Hart and Thompson 1968) examined the behaviour of shoppers in the city following the introduction of a pedestrianisation scheme. The technique adopted in the study was on-street interviews where shoppers were asked to draw on a map the places and routes that they had followed or were going to follow during their visit to the city centre. This method is a more detailed means of assessing pedestrian flows which in their simplest form (i.e. pedestrian counts at specific places) are widely used. Although the basic data offer little in terms of understanding individual's behaviour, recent studies have incorporated more detail and these have more potential for understanding shopping patterns within pedestrianised zones.

Much of the previous research in this area merely describes speed/flow relationships, pedestrian numbers on pavements and crossing roads, accident risks and trip length and type. However, some aspects of pedestrian movement are related to pedestrian perception and attitudes towards the street environment.A similar approach to the Chichester survey was undertaken by TEST (1976), when respondents were asked to draw maps of their routes and their attitudes towards the area were also recorded. Hills (1976) assessed the before and after attitudes towards the pedestrianisation of Liverpool Street and many other studies have been conducted using similar approaches. Although these offer substantial information on pedestrians' perception of city streets, they contribute little to the study of how these attitudes affect their behaviour. There have been several studies on the distance people are prepared to walk (TEST 1976, Rutherford 1979) but there has been no micro-scale analysis of the factors that might cause variations in the propensity to walk (May, et al 1985). Only two studies have examined the link between environmental factors and walking patterns. Hills (1976) found that after pedestrianisation the numbers of people visiting the centre had reduced but that the number using buses had risen, although the walking distances had increased. Hills also found that certain routes would be taken in order to avoid crossing roads and using footbridges. Lovemark (1972) found that the willingness to walk varied with environment and transport provision. In a study of two aesthetically differing areas but with similar road crossing delays and comparable levels of transport provision, trip lengths were found to vary by as much as 30%. Since then, however, little work appears to have been done.

There have been two studies of the link between environmental factors and route choice. The TEST report (1976) found that environment was rated far below the directness of route in determining route choice. Research by Senevartine and Morrall (1983) generally agreed that distance related factors were most important for route choice but found that for shopping trips environmental criteria became more important. For all walking trips environmental factors such as 'number of attractions', 'least crowded' and 'number of street crossings' were ranked fourth, fifth and sixth after distance related criteria. For shopping trips, however, the 'number of attractions' was ranked second after 'directness of route'.

Brown (1988) carried out an observational study of the behavioural patterns of people visiting the award winning Park Centre shopping complex in Belfast. 153 people were observed from their time of entry to their time of departure of the centre. Information was collected on the total time spent in the centre, the number, nature and sequence of shop visits and the composition of the shopper group. Brown identified three types of shopping behaviour; leisure shopping, chore/purposeful shopping and mixed activity shopping. These are similar to the lifestyles approach mentioned earlier. Brown characterised the leisure shopper as one who stayed a long time in the centre, visited many shops with much backtracking and who often stopped for refreshments. Purposeful shopping is characterised by short stays, few shop visits and a circulation pattern that seemed to minimise the expenditure of physical effort. Mixed activity shoppers were divided into two groups; those who carried out the chore shopping first and those who did it last. Brown discovered that the shopping type was determined by the composition of the group, females spent more time in the centre than men, but groups with children stayed the longest. The study also identified different patterns of behaviour for comparison and convenience goods. Shops visited most tended to be those selling comparison goods, but the shops selling convenience items had higher levels of purchasing rates: The average enter:buy ratio for all shoppers and stores was 0.37, i.e. 1/3 of those entering stores made a purchase, for convenience stores this was 0.75, or 3 in 4 customers would make a purchase, but for comparison stores this figure was 0.21, only 1/5 of those entering the store would buy something.

These results are very relevant to this research project which is concerned with the degree of intensity with which the shopping activity is carried out. One of the aims of this study is to discover whether an improved shopping environment will result in longer shopping trips with an increase in the number of destinations visited. This review has shown that there has been very little work carried out in this specific field but what has been done (Lovemark 1972, Senevartine and Morrall 1983, Brown 1988) indicates that there is a relationship between environment and behaviour. The Plymouth study will build on past work and will seek to establish if and how attitudes towards pedestrianisation affect shopping behaviour in the traffic-free zone.

The research project also intends to identify certain types of shoppers to see if common characteristics result in a particular kind of shopping activity. Although much work has been conducted into consumer choice of shopping centres, stores and goods, little information has been compiled on how these characteristics can affect movement patterns in a shopping environment. This research will therefore attempt to adopt some of these marketing techniques for the study of pedestrian shopping movement. Pedestrians' travel times, their frequency of visits, the type of goods purchased and their socio-economic characteristics will all be analysed. The hypothesized relationships are discussed in later chapters.

The above review illustates that time is one of the important factors influencing shopping behaviour and recent research (Bacon 1984) has indicated that an individual's value of time can influence his or her choice of shopping centre and the time spent at the chosen destination (Brown 1988). The idea of placing a value on time aids the understanding of the behaviour of individuals and helps to explain how and why people apportion time to various activities. The study of the value of time is a well established area in transport studies but has rarely been applied to explain shopping behaviour and parking choice. The concept is, however, particularly relevant to this research since the study of the various amounts of time spent during a shopping trip (travel time, queuing time for a parking space and the actual time spent shopping) forms a key issue of the PhD model. An individual's value of time will be influenced by attitudes towards the shopping activity and this will affect his or her behaviour during the trip. Since this is an important theoretical area and because it is so pertinent to the current research, a seperate review of the concept of the value of time, some of its applications and its relevance to this present research are discussed in Chapter Six.

CHAPTER SIX

THE VALUE OF TIME

6.1 The Theory of the Value of Time

The concept of the value of time has been applied widely in many research areas. Because its applications are so diverse, this review will be restricted to a discussion of its basic components and only studies relevant to the current research will be examined in detail.

The concept of the value of time is based on the assumption that the main purpose of transport is to move people or goods from one place to another in a reasonable time and at a reasonable cost. Value of time is concerned with the relationship between cost and time, and the various 'trade-offs' between them. It is most commonly used to measure the value of travel time saved and can be applied in the study of;

1. Different travel modes.

2. The appraisal of new transport systems, the upgrading of existing systems or improvements in their operating procedures.

3. Different route choices.

Travel modes have many different attributes but the value of time is principally concerned with their cost and time. For example, it is often more expensive to travel by train than by coach, but it tends to be much quicker. An individual who is prepared to pay more in order to save this time would then be assumed to place a higher value on time than another who is not prepared to accept this trade-off. Studies looking at modal choice include those by Beesley (1965), Bates (1984), Nassi (1986) and Weatherell (1983). The introduction of new transport systems or the upgrading of an existing one normally are designed so that journey times can be reduced. In order to evaluate the benefits of these new developments, a value has to be placed on the time that is saved. The Leitch report for example, conducted a major Goverment funded review of the use of the value of time for the appraisal of trunk roads (1977).

A given route may be longer but it may be cheaper, for example, a toll bridge may cut journey time but its cost may deter people from using it. Such people would be assumed to have a lower value of time than those who use the bridge. Atkins (1983), Harrisson and Quarmby (1969) have examined the relationship between route choice and the value of time.

The means used to calculate value of time are diverse, but for individuals it is normally determined by four major factors (Pope 1979):

1. Socio-economic characteristics

2. Journey purpose

3. Modal choice

4. Modal characteristics

Socio-economic characteristics include an individual's income, occupation, age, sex, domicile, and car ownership. The journey purpose could be travelling to work, during work or it may be a non-working trip made for shopping, leisure or other reasons. The mode used and the exact way in which time is spent during a journey also influence value of time. Walking time, waiting time, in-vehicle time and overall travel time are considered separately since people find it more troublesome to spend time walking and waiting for transport than being in the vehicle itself.

The value of time for freight transport is dependent on the type of goods, the storage available at the factory and demand for the product at its destination, but the most important factor is the value of the cargo.

Studies of the value of time differentiate between working time and non-working time (Atkins 1984).The value of working time is normally calculated in terms of the hourly rate of pay plus overheads such as national insurance contributions. Stopher and Meyburg (1976) identify two schools of thought on the appropriateness of calculating values for non-working time. The strict economic viewpoint regards non-working time as unproductive and therefore unimportant. The social viewpoint considers personal values and the 'willingness to pay' for different goods and services as an indicator of an individual's value of time.

Until recently research into working time dominated the field (Heggie 1976, Marks, Fowkes, and Nash 1986). However, the journey to work or commuting time has also attracted a lot of research, Hensher (1975) examined the savings in commuter time by posing hypothetical alternatives. Bradley et al (1986) conducted four studies that looked at both commuting and non-work travel and found that time savings were more highly valued for leisure travel than for commuting, and that trips for personal business and shopping trips had lower values of time than trips for visiting friends and recreation. These studies also found that value of time went up as travel time increases and that a higher frequency of travel reduces value of time. Bradley also confirmed the established belief that value of time increases with income and that retired people have a lower value of time. This, however, was not the case for part-time workers and the unemployed. Nassi (1986) examined household characteristics, individual characteristics and trip characteristics in his work on costs and travel times for observed choices and possible alternatives.

Some studies are critical of the basic determinants of the value of time and suggest that other factors such as comfort, safety, the quality of the scenery and even physiological measures (Goodwin 1976) are as important as time and cost. Although many studies have differentiated between walking and other travel modes, few studies have examined the value of walking time in any detail. These tend to consider walking time as a part of the total journey which includes other transport modes. Allouche (1972) concentrated on the minimisation of total costs when building a model to study the value of walking time of motorists. His model was based on the behaviour of motorists selecting a parking location but assumed that only the parking fee and the walking time from the car park to the final destination would affect the decision maker. Allouche did not consider other variables such as the weather, street gradient or the environmental quality of the walking route;

> except with shoppers it is unlikely that parking decisions take much account of the environmental quality along the path followed to on-foot destinations. (Allouche 1972).

Alouche's model in its simplest form was;

$$C = c + xd$$

Where C = Total cost

c = parking fee

d = distance from parking location to final destination

x = the disutility of walking 1 unit of distance

Allouche calculated that the value of x would be dependent on a number of factors influencing an individual's value of walking time, including his or her propensity to walk, walking speed, journey purpose and the length of time the car is parked, which would then influence the motorist's choice of parking facility. Recent research (Salomon 1986) has built on this early work but with more emphasis placed on behavioural variables that influence a motorist in making a parking decision.

Salomon (1986) examined driver's choice on two levels; the initial decision to make a journey by car to a certain centre and the choice of parking facility on arrival at the selected destination. The first is influenced by the perceived parking provision at the destination and by alternative travel modes and destinations open to the motorist. The second choice, of parking facilities at that destination (assuming the driver decides to make a car-borne journey) is influenced by a number of factors; willingness to pay parking fees, attitudes towards walking, or ability to walk, time constraints, familiarity with the transport infrastructure and the actual number of parking spaces available. These variables can be categoried into two groups; level of service factors and personal characteristics. Recent models (Van der Groot 1982) have tended to concentrate on the former but have ignored personal characteristics. Salomon (1986) believes that more emphasis should be placed on these characteristics, which are strongly influenced by an individual's value of time. He suggests that in a hypothetical situation, a driver is faced with two choices; parking at a facility where there is a high level of certainty with regard to availability, costs and walking distances or parking at an alternative facility which has higher levels of uncertainty with regard to availability and costs but has shorter walking distances. Salomon states that the decision will be influenced by the driver's value of time, income and propensity to walk. He differentiates between the value of in-vehicle and out-of-vehicle time and suggests, for example that a driver who increases his or her searching time by looking for ideally located facilities that would minimise walking times, would have a low value of in-vehicle time, but a high value of out-of-vehicle time. Salomon's case study in Jerusalem's central business district found that searching times for women were shorter than for men and that women generally searched in areas or car parks that had lower probabilities of occupancy. Searching time was also negatively correlated with education levels, probably because better educated people had higher values of time and planned their routes in order to minimise search time. Salomon concludes that although his findings are far from conclusive they do indicate the need for a behavioural disaggregate approach in the understanding of parking behaviour in order to formulate realistic parking policies. Although Salomon looks at the behavioural aspects of parking behaviour, an important limitation of his research is his failure to consider the behaviour of drivers once they have left their cars and how this could influence parking behaviour.

The current research is concerned with the behaviour of motorists in finding a car parking facility in Plymouth's city centre but is also going to examine how their shopping behaviour in the city centre affects the availability of parking facilities. The current research is therefore concerned with individuals' values of time in terms of both their parking and shopping activities. The work will assume that because pedestrianisation has changed the number and the location of parking facilities, more time has to be spent during a shopping trip in finding a parking space and walking from that space to the required destinations. Searching time is hypothesised to have increased because of the reduction in the overall number of spaces, and walking times from the car park to the shops have increased because of the changed location of parking facilities. These two changes are unavoidable, and how an individual responds to them, in terms of their choice of shopping centre and parking facility at that destination will be an indication of their value of time. The model will assume that car-borne shoppers will have a sufficiently high value of time so that time spent on these activities will be minimised. The behaviour of individuals in the shopping centre itself, is however a matter of choice.

Previous research has suggested that shoppers can be categorised into various groups according to their shopping patterns (Stone 1954, Darden and Reynolds 1971, Darden and Ashton 1974). Brown's (1988) three categories, the leisure shopper, the purposeful shopper and the mixed activity shoppers were identified according to how they spent their time in a shopping centre. This suggests that people have differing attitudes towards shopping and that as a result different values of time are placed on the shopping activity. Brown also found that the composition of the shopping group and the type of purchases made, influenced the time spent engaged in the shopping activity. Other research (Lovemark 1972, Senevartine and Morrall 1983) suggests that environmental quality will influence the time spent in an area. One of the aims of pedestrianisation in Plymouth was to improve the environment. This research therefore hypothesizes that if an individual likes the change then he or she will be more inclined to spend more time in the pedestrian zone. This research will therefore include these factors as well as the more traditional personal characteristics of age, sex, income, domicile (Pope 1979), which determine an individual's value of time, when studying the behaviour of people in the city.

CHAPTER SEVEN

THE CONCEPTUAL MODEL

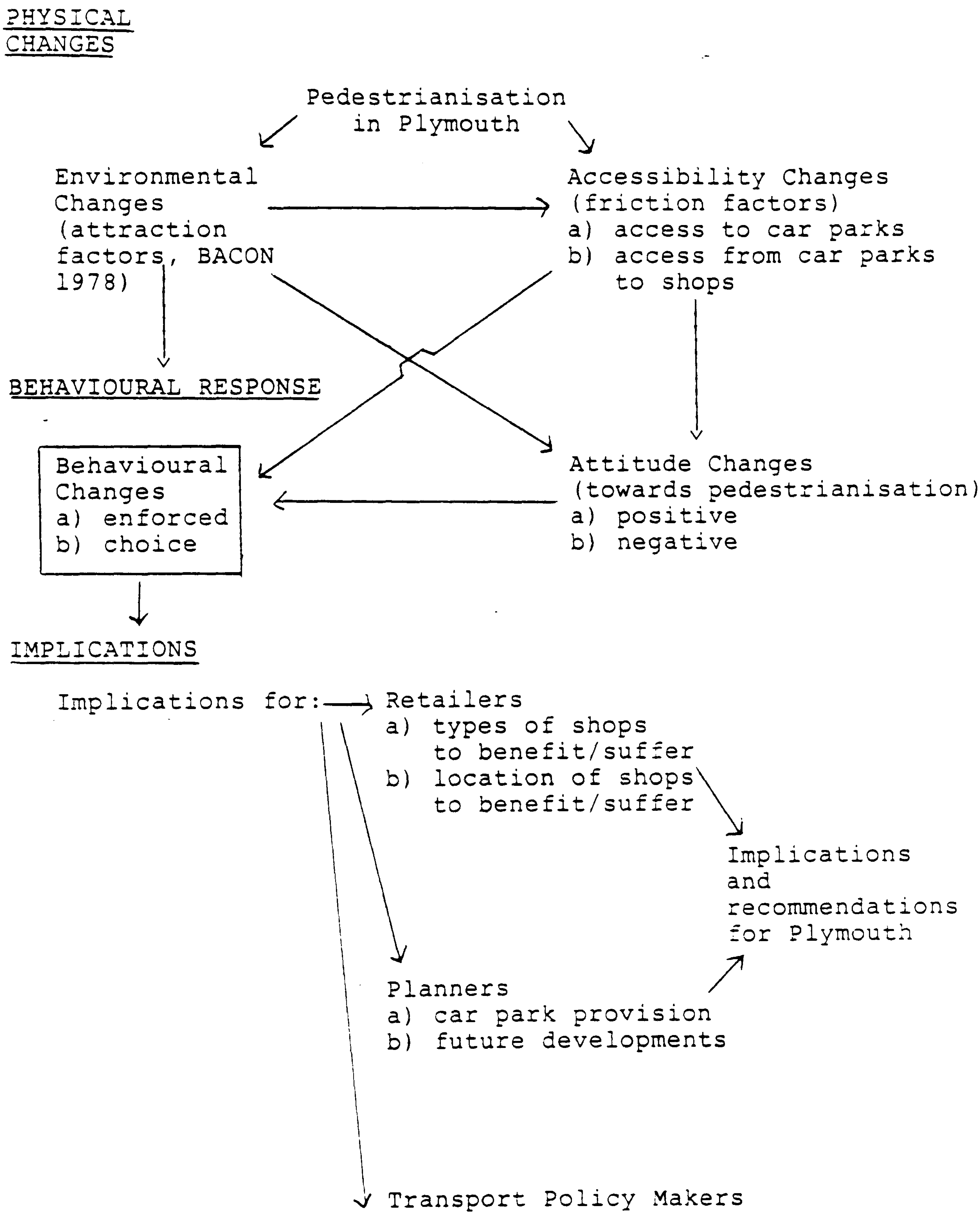
7.1 The derivation of the model

This chapter will explain the theoretical derivation of the model and will go on to describe in detail its various components and their inter-relationships.

The structure of the model is illustrated in Figure 7.1. Pedestrianisation caused changes to the physical environment of the city centre.The model examines how these changes have affected the attitudes and behaviour of car users in Plymouth, and studies the implications of this not only for Plymouth but for retailers, planners and policy makers in other areas.

When pedestrianisation was introduced in Plymouth, there were two important physical changes to the city centre; environmental changes and accessibility changes (Fig 7.1). Environmentally the city centre was improved aesthetically and also in terms of safety for pedestrians, less congestion and ease of movement within the traffic-free zone (Chapter 3). The process of pedestrianisation initially reduced the accessibility of the city centre, particularly for car users, because the scheme temporarily reduced the number of parking spaces and the replacement facilities were relocated at longer walking

FIGURE 7.1 THE CONCEPTUAL MODEL



distances from the shops (Chapter 3). Car users' access to the car parks and from the car parks to the shops was therefore changed. Previous experience in other cities has shown that accessibility to newly pedestrianised areas is of paramount importance (TEST, 1981) and in Plymouth this was particularly evident when car users accessibility problems became the most controversial aspect of the scheme (Chapter 3).

The literature review on accessibility (Chapter 4) revealed a vast amount of interest, and research on the subject in a variety of areas. Much of this work has looked at the possible relationships between consumer behaviour and access to opportunities (Hansen 1959, Vickerman 1974, Reilly 1931, Huff 1964, Stoufer 1940, Ghosh 1986). Other researchers, (Copley 1975, Ness 1969, Scott 1974, Sandhal and Percival 1972, Butler 1978, Ballas 1976 and Rutherford 1980) all studied accessibility to investigate pedestrian movement, using a variety of methods based on Hansen indices and gravity model formulations. Most studies divided up the research area into zones using a 'generalised model'. These aggregate models study the flows between specified nodes but are unable to identify specific individual behaviour. Such methods take the emphasis away from the individual level, and although this increases their transferability to other areas and situations, their accuracy in describing behaviour diminishes as a result. An approach like this would be inappropriate for the particular situation in Plymouth which involves the detailed study of car users'parking and shopping behaviour. Because of this a disaggregate model is required which will enable these individual behavioural factors to be considered.

The model, will, however, adopt some of the relevant methods and assumptions used in previous research. The car users' accessibility will be measured on two levels, firstly, accessibility to the car parks and secondly, accessibility from the car parks to the shops. The behavioural section of the model will incorporate the concept of zones, a method widely used in past accessibility modelling procedures (Hansen 1959, Dalvi and Martin 1976, Cochrane 1974 and Higgs 1976). The car user's domicile (reflected in his or her travel time), the car park chosen, and the shops visited will represent the three categories of zones between which the motorists travel.

Accessibility models, particularly those investigating trading patterns frequently use attraction and friction factors for determining travel rates between such zones (Bacon 1978). Friction factors are normally concerned with the costs of travelling between zones, and in this research such costs will be measured in terms of the time taken to travel between the zones, a common approach often adopted in transport research (May and Montgomery 1983). Thus the friction factors between the zones in the Plymouth study will be;

a) Access from domicile to the car park (including queueing time)

b) Access from the car parks to the shops

Attraction factors in previous retail research have been the services that a particular service offers in terms of the number and variety of shops, price of goods and the convenience of shopping (Kunkell and Berry 1968, Stephenson 1969, Ghosh 1986). In this research these will be considered, but the most important attraction factor, reflecting the most significant positive physical change, will be the improved pedestrian environment. By studying the behaviour of car-borne shoppers in terms of these attraction and friction factors it will be possible to evaluate the balance made between poorer accessibility and improved environment.

Additional factors influencing the trade-off between these aspects of pedestrianisation are the attitudes of the car users to the scheme. Experience in other cities has shown that the attitudes of the public are important to the success or otherwise of a pedestrianisation scheme (Clyde 1976, Copley 1975, Stewart 1979). In this present research attitudes can either be positive or negative, that is individuals can approve or disapprove of the scheme. The attitudes towards the Plymouth scheme have been generally favourable, although car users tend to be less enthusiastic than other city centre users. The most common reason for being against the scheme is the reduction in car parking facilities, and even those in favour of pedestrianisation believe that this is a problem. The accessibility within the city centre has also been criticised, with many people stating that the longer walking distances are too onerous. On the other hand, the main reasons car users gave for being in favour of the scheme were predominantly environmental with safety, less congestion, freedom of movement and aesthetic reasons most frequently mentioned. This model will hypothesize that peoples' attitudes towards pedestrianisation will influence the way they behave in the city centre and how they accept the trade-off between accessibility and the environment.

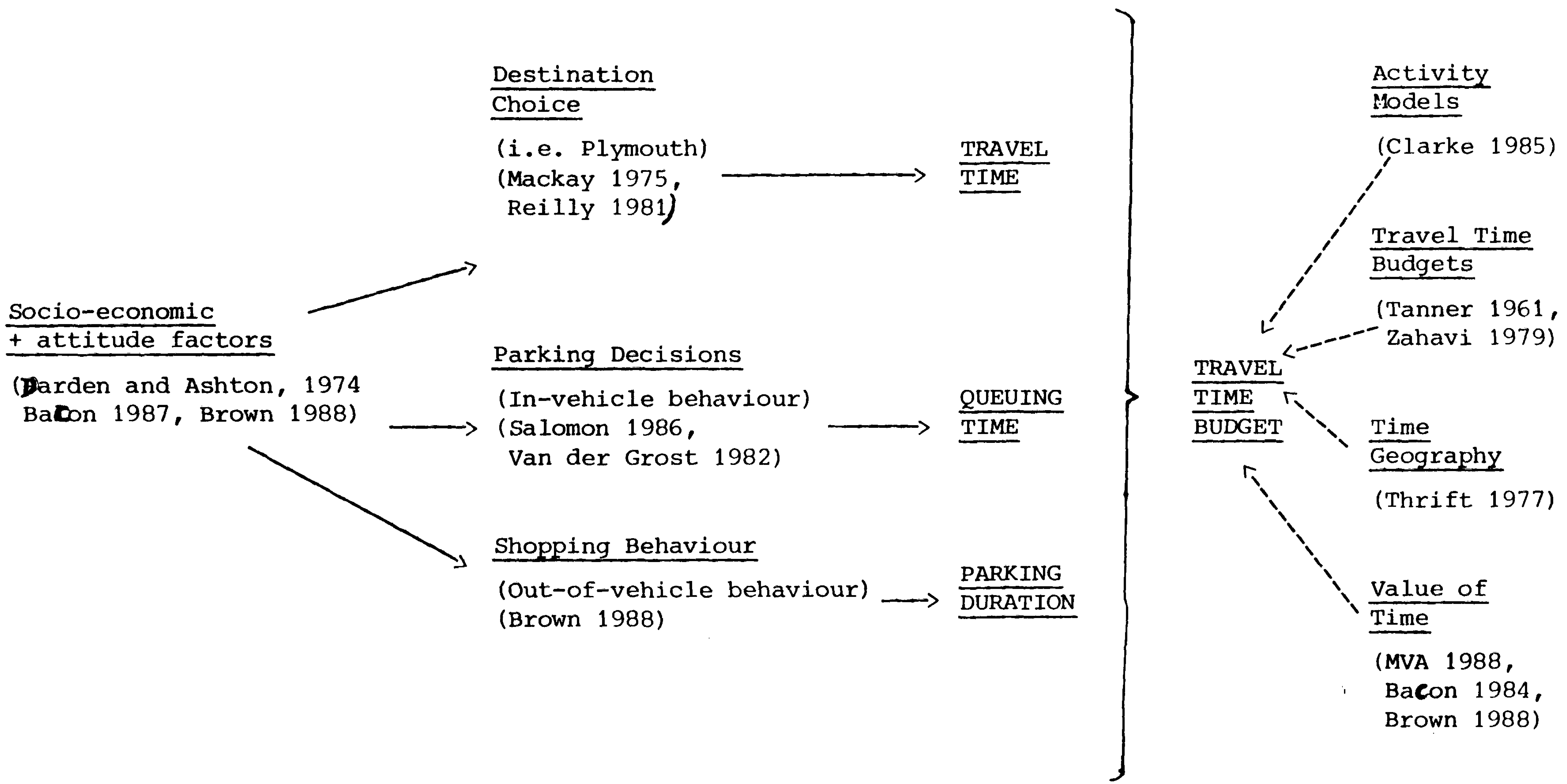
This model examines how people accept this trade-off by studying their behaviour in the city centre. This behavioural element is the key issue of the model since by studying car users' behaviour over time, the model will identify behavioural changes that illustrate if and how people have adapted their behaviour, whether these behavioural changes are positive choices or enforced upon them, and as a consequence, whether pedestrianisation and its implications are acceptable to them. Because of its importance, the behavioural element of the model is shown in more detail in Figure 7.2.

The recurring theme throughout this research is temporal, in particular the way car users' allocate time to various parts of their shopping trip. A major contribution to the methodology threfore derives from time/space geography and the study of the value of time.

Activity modelling and time budget models are two closely related methods that have been employed to study the role that time plays in determining peoples' behaviour. Activity models (Clarke 1985) examine the behaviour of household members with regard to how they behave when allocating time to different activities within a framework of constraints imposed by the physical and social environment. A similar

FIGURE 7.2

THE BEHAVIOURAL ELEMENT OF THE MODEL



approach is that using travel time budgets (Tanner 1961, Zahavi 1979) where the basic assumption is that people are only prepared to spend a limited amount of time travelling. An individual's time budget will therefore not only influence his or her travel behaviour, but also his or her destination. Space-time budgets are an extension of this approach, and are based on the idea that activities take time and that the activity can be measured in physical time units and that because time is a resource, it can be budgeted (Thrift 1977).

Recent research has indicated that an individual's value of time can influence his or her chcice of shopping centre and the time spent at the chosen destination (Bacon 1984, Brown 1988). The study of the value of time is a well established area in transport studies but has rarely been applied to explain shopping behaviour and parking choice. The concept, incorporating space-time budgets, is, however, particularly relevant to the present research since the study of the various amounts of time spent on different activities during a shopping trip forms the key part of the model.

In the past, research in travel time budgets has been based on samples of either individuals' or households' activity diaries which has enabled observations and calculations to be made on how activities are and can be performed (Thrift 1977, Hensher and Stopher 1979, Kobyashi 1979). This present research uses as its data base the revealed travel behaviour of car-borne city centre users. This travel behaviour is comprised of several travel stages, these are;

1. Travel time from domicile to city centre (and back)

2. Queuing time for parking facilities

3. Parking duration

These stages together comprise a respondent's Total Travel Budget (TTB). The TTB is assumed to be the maximum time an individual can spend, needs to spend or desires to spend, on a shopping trip to the city centre.

Previous research into travel behaviour, particularly the concept of the value of time, has distinguished between in-vehicle time and out-of-vehicle time. Walking time, waiting time, in-vehicle time and overall travel time have all been considered separately in the past since people appear to find it more troublesome to spend time walking and waiting for transport than being in the vehicle itself (Pope 1979). Research into the value of time has found that individuals place different values on their time according to their own socio-economic characteristics, their journey purpose, mode choice and modal characteristics, Bradley (1986), for example, confirmed that an individual's value of time will have a positive relationship with income, that retired people and women have lower values of time, shopping trips have lower values placed on them than leisure trips, and that values increase with trip length. Salomon (1986) in his study of parking decisions found that the values of in-vehicle and out-of-vehicle time were different and that the values individuals placed on them were related to their shopping behaviour. Goodwin (1976) stated that environmental perception was also relevant to the way individuals value their time, and consequently how they allocate it.

The way in which each respondent allocates time to various stages of his or her trip to the city centre is therefore an important aspect of this research as different patterns of behaviour can then be identified. Additionally it is the relationships between the various stages that will help to indicate acceptance or otherwise of the trade-off between accessibility and the environment. The three main components of the TTB are now discussed in more detail so that the possible relationships between them can be clarified.

1. Travel time from domicile to city centre

The travel time will obviously be dependent on where the car user lives, although there will be variations according to the time of day, day of the week, driving speed and other factors such as weather and road conditions. Peoples' perceptions of travel time can also vary with their socio-economic characteristics, for example it could be anticipated that an individual with a high value of time would over-estimate the time taken. Previous research also suggests that travel time will have an influence on peoples' shopping behaviour, Mackay (1975) for example, found that a longer travel time will normally mean a longer visit. Research into accessibility to consumer centres has previously discovered the importance of travel time in governing destination choice (Reilly 1931, Stopher 1940, Ghosh 1986). By studying travel times at various stages of the pedestrianisation schemes development, the model will also be able to draw some tentative conclusions on destination choice. For example, significant changes in travel time could indicate that some former city centre users are no longer visiting Plymouth.

2. Queuing time for parking facilities

Queuing time, that is the time a car user spends looking for a parking space on his or her arrival in the city, is influenced by a number of physical and behavioural factors. The number of spaces available in the city centre is the obvious physical constraint, but this is also influenced by behavioural factors such as the level of demand for the facilities and the length of time other car users are occupying the spaces. Traditional methods of assessing car parking provision have tended to concentrate on the physical aspects of provision, counting the numbers available and the scale of their use. More recently researchers are placing emphasis on the demand and behaviour of individual users and have become increasingly aware that

'parking is no longer a pure transportation engineering problem but can in fact serve as an important tool to shape activities'

(Salomon 1986)

This has heralded new interest in the behavioural aspects of parking and models are being formulated to account for it (Van der Goot 1982). These models tend to concentrate on the driver's choice of parking facility and only consider their out-of-vehicle behavior in a peripheral way. Out-of-vehicle behaviour is, however, important in determining the choices of facility a driver will make. For example, some motorists may wish to park at a particular location close to their final destination and as a consequence may consciously increase their searching time in order to access it (Salomon 1986). Others may chose their parking facility because of the ease of parking and will have shorter queuing times at the expense of walking longer distances to the shops. For some car users, a delay at the parking stage may mean that less time is available to spend in the city centre, while for others it may just delay the shopping activity without affecting its duration. The model therefore studies not only the queuing time, the car park used, their satisfaction with the facility, and the reasons for making that choice, but also the out-of-vehicle behaviour at the destination.

3. Parking duration

This is the amount of time that the car is parked while the car user is carrying out the purpose of his or her trip. The model is concerned only with shoppers, but distinguishes between 'pure' shoppers, i.e. those that have only visited shops during their stay in the city centre, and 'leisure' shoppers , i.e. those who have also visited cafes, pubs or restaurants during their visit. Car users who have combined shopping and work are considered seperately as 'others' in the study because the time they have spent in the city centre would generally not be a result of their shopping activity, but primarily a result of their working hours. The way in which car users conduct their shopping activity is of major importance to the model as it is concerned with the choices made within the city centre and whether similar types of people display similar behavioural characteristics. The model therefore draws from the research carried out in the marketing and retail fields which has examined intra-centre shopping patterns(Brown 1988). Previous research (Stone 1954, Darden and Ashton 1974, Brown 1988) has also shown that it is possible to apply market segmentation techniques to identify similar types of shoppers.

The research in Plymouth will investigate how the improved shopping environment has affected consumer behaviour and bases its assumptions on the work of Senevartine and Morrall (1985) and Lovemark (1972) which suggests that an aesthetically pleasing environment will cause people to spend more time in a shopping centre. This research therefore hopes to identify groups of shoppers according to the intensity with which they shop. Shopping intensity will be measured in terms of the number of shops they have visited per hour. This will to a certain extent , reflect the location of the shops visited in relation to where the car users have parked. The spatial distribution of shoppers' destinations will therefore also be included in the model.

The manner in which people behave in all stages of their shopping trip are hypothesized to be influenced by a number of attitude and socio-economic and demographic factors.

Attitude Factors

It has already been mentioned that attitudes towards pedestrianisation can influence an individual's travel behaviour. For example, those who like the scheme may spend more time on the shopping activity, going to more shops and visiting the city centre more often.They may partake in more 'non-retail activities' such as window shopping, sitting around, having coffee etc, regarding shopping as a day out rather than a purely functional activity (Bellinger and Korgaowkar 1980). Such car users may not be concerned about the poorer accessibility to the car parks and from them to the shops. Those disliking the scheme may be more purposeful shoppers who want to minimise the time spent in the city centre and these car users may be less tolerant of the poorer accessibility to and within the city centre. Such car users may avoid the city centre and minimise any time that they have to spend there.

Socio-economic/demographic Factors

The basic factors of socio-economic class, age and sex will not only give a more detailed breakdown of the composition of the car-borne city centre shopping population, but will also be central to the explanation of peoples' travel time budgets.For example, the research will be able to discover if women spend more time in the city centre shopping at a lower intensity than men (as suggested by earlier research into the value of time, MVA 1988).

Car users' travel budgets will be calculated at three stages of the pedestrianisation scheme's history and this, with other details concerning the operationalisation of this model are discussed in the next chapter.

This model involves the study of several different research areas whose inter-relationships have not previously been researched in this manner. The model will contribute to the relatively new concept of a behavioural approach in the study of parking provision. This work will also contribute to the limited amount of research on the attitudinal and behavioural aspects of intra-centre shopping activity. The model not only considers these two neglected research areas but actually links the two in a way that has not previously been attempted. The research project will consequently assess not only the physical change to the city following pedestrianisation but will also identify any resulting changes in the composition of the shopping population in the city and how these may relate to the parking provision in the city. The testing of this new approach will offer information on city structure that will be able to identify the types and the location of shops that have benefitted or suffered from pedestrianisation. This research will also help local planners to appraise the level of parking provision in the city and will shed more light on the role parking facilities play in supporting the retail economy. The model will also be appraised for its usefulness, transferability and applicability in urban planning and will consequently be of interest to model builders and policy makers.

CHAPTER EIGHT

OPERATIONALISING THE MODEL

8.1 Introduction

The conceptual model, described in the previous chapter illustrated that the physical changes in the city centre are hypothesized to result in car users adapting their behaviour. This research needs to measure these changes. Chapter three has described the physical changes in the environment following pedestrianisation, and the consequent changes in accessibility in terms of car parking facilities and their location.This chapter explains how the data concerning the behavioural element of the model was collected and describes the form it takes.

8.2 Data Collection

This research aims to investigate how people have responded to the changes in the city by examining their attitudes and behaviour during this time. The data that will be used in the model are in two forms:

1. Data concerning empirical changes in car parking provision, pedestrian and traffic flows, and the progress of landscaping, (described in Chapter 3). This is supplied by the County Council City Engineer's Department (the collaborating body).

2. Original data concerning the attitudes and behaviour of car-borne shoppers. This data has been collected by conducting three major surveys. Supplementary data on retailers' and non-car users' attitudes has also been collected. Table 8.1 details all surveys relevant to this research, the ones highlighted are the three most important, examining car-borne shoppers' attitudes and behaviour. These surveys are those that will be discussed in detail in this section.

8.3 Survey Technique

The research required information relating to shoppers' travelling and parking behaviour, their shopping behaviour, and their attitudes towards the pedestrianisation scheme. There are a number of ways of collecting such data. Household or individual travel diaries have often been used (Chapin 1968,etc) to gather data on weekly travel behaviour, particularly for use in studies of travel time budgets (Tanner 1961, Zahavi 1978).This present research, however did not require data on weekly or even daily behaviour, but specific information on how respondents behaved while on a shoppping trip to Plymouth City Centre. It was felt that retrospective interviewing of this nature would be unreliable since people would be less accurate in their responses than if they were interviewed immediately, on their return to the car parks. Furthermore, the wide range of information required prohibited the use of more widely used survey techniques. For example, previous surveys of parking behaviour have concentrated on

TABLE 8.1 SURVEYS RELEVANT TO THE RESEARCH

1982 (Nov)	Street Survey. 2322 people interviewed on their attitudes towards pedestrianisation.
1983 (Feb)	Survey of Retailers' attitudes towards pedestrianisation.
1985 (Jan/Feb)	Car Park Survey. 1093 people interviewed as they returned to their cars.
1987 (Feb)	Street Survey. 200 people interviewed on their attitudes towards pedestrianisation.
1987 (March)	Survey of Retailers' attitudes towards ped'. (conducted by the Junior Chamber of Commerce).
1987 (April)	Car Park Survey. 3328 questionnaires left on car windscreens.

1987 (May)	Survey of Retailer's attitudes towards ped'. (conducted by the Junior Chamber of Commerce).
1987 (Oct)	Street Survey and Out-of-Town ASDA Survey.
1988 (Nov)	Car Park Survey. 3728 questionnaires left on car windscreens.
1988 (Nov)	Street Survey. 400 people interviewed on their attitudes towards pedestrianisation.

car users' behaviour inside the car park and have used technological methods such as time lapse photography to collect data. Although this method would collect accurate data on the occupancy of the car parks, and of the length of stay, it would not supply information on car users' out-of-vehicle behaviour or their attitudes.

The means of collecting data on shopping patterns is also varied. Previous studies have observed pedestrian movements in two main ways (May et al 1985);

1. Systematic recording.

2. Tracking/ Interviews.

The first method, using a variety of photographic aids, was inappropriate for this work as it does not allow indepth individual studies, but concentrates on target groups. For example, it has been used extensively for accident studies where groups such as children are observed in particular situations, i.e. at accident blackspots, and unattended crossings (Chapman 1980).

The tracking method involves the following of individuals to monitor their route choice and activities. This has not been used that often as it is time consuming and expensive (Routledge 1974, Brown 1988). Hill (1984) suggests that questionnaires asking people about their walk route are reliable ways of collecting similar information. Additionally this approach also allows the researcher to ask the respondent about their attitudes and reasons for their behaviour. The questionnaire can be administered in two main ways; direct personal interviews or mailed, self-completed questionnaires. Both of these techniques have their advantages and disadvantages.

One of the main advantages of the direct interview is the ability to ensure that the respondent fully understands the purpose and reasons for the research. Interviewing also allows problem questions to be explained and respondents can be probed for the relevant information if, for example, he or she appears to misunderstand the question. This approach can also enhance the response rate as people are often more willing to respond verbally, being more confident of their speaking ability than their writing style. The presence of an interviewer can also ensure that all the questions are answered in the correct order. A more complex questionnaire can be used in a direct interview situation, using, if necessary questionnaire aids that may encourage or prompt the respondent, such as flash cards, lists, pictures and other handouts. An interviewer can also make assessments on the respondents background, such as ethnicity, age and socio-economic class. Questionnaires conducted in this manner also enable the interviewer to build up and maintain a rapport with the respondent which may lead to more accurate and honest answers to particularly sensitive questions.

Interview studies, however, can have considerable disadvantages. The personal contact that they involve can result in an interview being fraught with bias. The interviewer can lead the respondent and involuntarily convey his or her own values by tone of voice, by pausing or probing with leading questions, by agreeing with the respondent to maintain the rapport or simply by dress and even accent. The interviewer may also be tempted to phrase the questions differently for different respondents, again leading to bias and problems in response comparison. There are also logistic problems concerning this kind of data collection. Direct interviewing can cost a lot of time and money. The interviews can take a long time to conduct and the sampling time-period required to gain a sufficient sample size may be too long for all questionnaires to be comparable. Interviewers have to be briefed, organised and trained and the cost of this plus wages and expenses can prohibit the use of this technique. When this is the case, many researchers have used postal questionnaires as these are often cheaper and less time consuming to conduct. Postal questionnaires also have a number of other advantages.

The need for standardized wording in the questionnaire and the lack of an attendant interviewer means that there is far less room for unintentional bias. The questionnaire can be completed at the respondents' convenience and there is a greater assurance of anonymity for them. However, the most powerful arguement for the use of postal surveys is the large sample sizes that can be achieved at comparatively low cost.

However, there are several problems associated with such self-administered postal questionnaires.The mailed questionnaire lacks the personal approach achieved with a direct interview. The questionnaire therefore has to be as simple as possible, minimising any potential difficulties respondents may encounter with the questions. The respondent may also answer the questions in the wrong order, leave out sections or may delay tackling the form, all of which may result in less accurate responses. There is also no possibility of checking the data by non-verbal assessments concerning the respondents age, ethnicity or socio-ecomnomic class. However, the main disadvantage of using a postal questionnaire concerns the low response rates achieved and the resulting problems of bias in the sample. Postal surveys sometimes receive response rates as low as 10 percent and the people who do not answer often have similar characteristics, in other words,

> 'non-response is not a random process'
>
> (Oppenheim 1986)

Previous research has found that poorer, older and less educated people are less likely to respond to postal surveys than younger, better educated individuals (Salomon 1986). Individuals that feel strongly about the research subject are also more likely to respond than someone who has no firm opinion.

The problem of a biased sample size can, however, be minimised. Ten factors have been identified that can affect the response rate of postal surveys (Bailey 1987, Selltiz et al 1959).

1. Sponsorship of the questionnaire

Sponsorship of the survey by respectable educational establishments, local authorities, the government or non-profit making organisations can encourage the reluctant repondent to reply. On the other hand, sponsorship by commercial firms can be counter productive with potential respondents wary of any possible ulterior motives. Previous research, however, is not conclusive on the effect of such sponsorships (Scott 1961, Jones 1979).

2. Attractiveness of questionnaire format

Previous research has examined the influence on response rate of the design of the questionnaire form (Scott 1961, Bender 1957, Dunlap 1950, Sudman and Bradeburn 1982, Alreck and Settle 1985). Little variation in response rate was found between the use of printed and duplicated questionnaire forms, and the colour of the paper used seems to have little effect on the respondents. However, questionnaires printed on the back of the covering letter seem to elicit higher responses than separate forms, although this probably reflects a greater appreciation for shorter questionnaires.

3. Questionnaire length

Respondents seem to prefer a less cluttered questionnaire even if it means that the overall length is greater (Scott 1961). Other studies (Goyder 1982) confirmed that longer questionnaires seem to gain similar response rates to shorter versions.

4. Cover letter

A covering letter is essential for all postal surveys. The phrasing of this letter is open to some discussion. Some researchers feel that a personal letter addressed to the potential respondent and signed personally by the researcher has a greater chance of gaining a reply than less personalised, photocopied letters. Experience has shown, however, that the actual content of the letter is more important than its presentation (Scott 1961).

5. Ease of completing and returning the questionnaire.

To gain a good response, the researcher must include explicit posting instructions that are clear and unambiguous.

6. Inducements to reply

The researcher must convince the potential respondent that his or her reply is important for the study. This can be achieved by a well worded covering letter that details the reasons and aims of the study. Additional inducements range from appealing to the respondent's better nature simply by persuasion, to rewards of money or participation in lotteries. Such gimmicks are normally associated with commercial firms and for academic purposes it is often better to spell out the aims of the study and convince the respondent that without their support the potential benefits of the research will be lost (Hendrick et al 1972).

7. The type of people who are included in the study

Sometimes surveys are aimed at particular groups of the population who may have a special interest in the subject under study. These targeted questionnaires often reap greater responses than more general sampling since interested people are more likely to reply. Less well educated people are least likely to respond (Salomon 1986, Scott 1961). There is no difference in the response rates between men and women, but nonresponse is higher for married women than for single women. Socio-economic class appears to have little effect on response rates.

8. Type of mailing

It is important that postal surveys include a stamped addressed return envelope (Ferris 1951).Previous research (Clausen and Ford 1947, Gullahorn and Gullahorn 1959, 1963, Dillman and Frey 1974, Kahle and Sales 1978) has generally found that first class or special delivery mail gain better response rates than second class mail. Stamped envelopes gain greater responses than metered envelopes (Scott 1961,Robinson and Agisim 1951, Erdos 1983, Guffey et al 1980), probably because it is more eye-catching, personal and also because respondents tend to feel guilty if it is thrown away. There is little evidence to suggestr that the use of stamps encourages abuse, with people steaming them off the envelopes for their own personal use.

9. Time of posting

The researcher should avoid posting the survey at the beginning of a holiday period, as this contributes to poor response rates. Apart from this it appears that day of week, or time of year cause minimal differences in response rates (Scott 1961).

10. Follow up letters

Response rates can be increased by as much as 20 percent by using follow up, reminder letters (Lansing and Morgan 1971, Heberlein and Baumgartner 1981).

In this research both direct interviews and postal surveys were used. Because of the 'on-going' nature of the pedestrianisation scheme, it was felt necessary to collect information at a number of stages of the schemes' development. Data had already been collected before pedestrianisation was introduced (Fig 8.1 illustrates how Plymouth city centre looked at this time) and it was decided that this survey should be followed up by two more; one immediately after the scheme was introduced when landscaping and replacement parking facilities were still being built (Fig 8.2)and another when the scheme had been fully completed (Fig 8.3). Such an approach would allow the research to trace both the short and long term implications of pedestrianisation and to examine how car-borne shoppers change their attitudes and adapt their behaviour during this period. In this research these three surveys will, henceforth be refered to as the 'before', 'during' and 'after' surveys.

The 'before' survey provided this research with initial information on car users' behaviour. However, the survey was not designed specifically for this project and consequently although most of this data is directly relevant to this work, some of the data collected in the following surveys is not available for the first stage. The need

to make the 'during' and 'after' data comparable to this initial data also restricted the survey and questionnaire design. However, care was taken to ensure that all questions were comparable and that significant sample sizes were established. Pilot surveys were also undertaken.

The 'before' survey was carried out by interviewing people as they returned to their cars. The cost of this, however , was prohibitive for the two later surveys and alternative methods were explored. It was decided that a kind of postal survey would be used. Questionnaires were distributed on to car windscreens, with freepost envelope enclosed. Previous surveys studying car park useage and parker behaviour have collected information using this method (Hill 1982, Salomon 1986). The disadvantages associated with this method have already been discussed but this was the only feasible method that would enable enough data to be collected to be comparable with the 'before' survey. The problem of poor response rate, and the potential resulting bias was hoped to be minimised because the of the importance and relevance of the project to the targeted group. A covering letter was included and the questionnaire was kept as brief and simple as possible. The use of follow up reminder letters, however was not employed as the method of sampling made the identification of respondents impossible. Because of the different survey methods, great care was taken to ensure that the questionnaire design and sampling procedure resulted in comparable data.

8.4 Questionnaire Design

The questionnaire was designed in order to collect information that would explain the behavioural element of the model (Fig 7.2, Chapter 7). The three surveys needed to gather data on the changes in respondents' travel time budgets that would develop the conceptual model into a form suitable for empirical analysis. Fig 8.4 illustrates the operational form of the conceptual model and explains what data was required for each component.

The total travel budgets for each respondent are comprised of three main components; travel time, queuing time and parking duration, which are all in turn, influenced by other factors.

Socio-economic and attitude factors are hypothesized to influence all aspects of a respondent's behaviour, and these shall be explained first.

Socio-economic Characteristics

The age and sex characteristics of the respondents were recorded in all three surveys. These basic factors will give a conventional breakdown of the types of people and how they allocate time in their shopping trip to the city centre. Respondents were asked to circle which category they belonged in. The age categories were chosen so that all data corresponded to that collected in the 'before' survey. In the later two surveys, respondents were also asked to give their occupation. The answers were categorized so that the results would be comparable to data collected in the supplementary surveys of non-car users.

Attitudes Towards Pedestrianisation

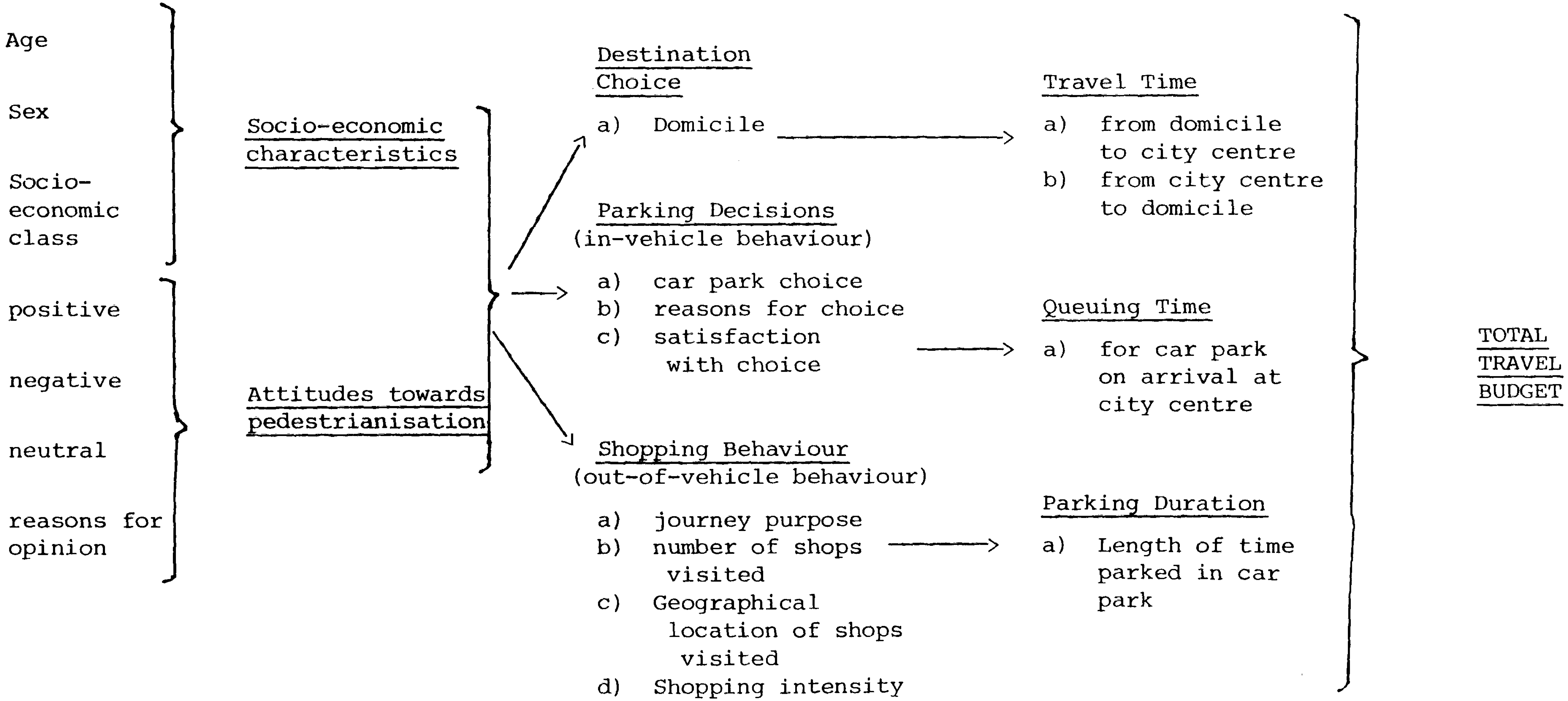
Studies examining attitudes are numerous and there are many detailed ways of measuring them (Thurlestone 1928, Fishbein and Ajzen 1972). The most sophisticated method of assessing people's attitudes is known as attitude scaling.An attitude is generally agreed to be defined as

> ' a state of readiness, a tendency to act or react in a certain mannei when confronted with certain stimuli'
>
> (Oppenheim 1986)

Attitudes are usually reinforced by an individual's belief accompanied by strong feelings that often result in the individual displaying a particular form of behaviour (Kretch, Crutchfield and Egerton 1962). Attitudes are normally percieved to be bi-polar, running from positive, through neutral to negative. This makes attitudes much easier to measure, but it does over simplify the issue, overlooking problems of attitude intensity, endurance and conflicting values. Attempts have been made to overcome these problems and a large amount of research is continually being carried out in this area. Attitude scales are the most commonly adopted technique and attempt to divide respondents into certain groups according to their stated attitudes. There are several types of attitude scaling techniques including Thurlestone scales, Likert scales and Factorial scales, all of which are techniques for placing people on a continuum in relation to one another in a relative rather than absolute manner. For projects based primarily on the study of attitudes it is essential that the most appropriate technique is used, however in this research, where attitudes comprise only a subsidiary element of the study a more simplified technique can be adopted.

This research hypothesizes that an individual's attitude towards pedestrianisation in Plymouth will result in him or her behaving in a particular way during a shopping trip to the city. Rather than measuring these attitudes on a scale reflecting the intensity of the emotion, it was decided to ascertain only whether the attitude was positive or negative, or whether the respondent held no strong opinion. The respondents were also asked the reasons for the views they held. It was felt that this would gather a more useful combination of information than the more specialised techniques used in pure attitudinal studies. Data collected in this manner would also be directly comparable to that already collected in the 'before' survey.All three surveys therefore incorporated a question asking people how they felt about pedestrianisation. The phrasing of the questions varied; in the 'before' survey, the questionnaire asked if the respondent thought that Plymouth City Centre should have a traffic-free pedestrianisation zone, in the later surveys the respondents were asked if they thought that pedestrianisation had improved the city centre. The choice of answers, however, was the same for all surveys; yes, no and don't know. In the two later surveys the respondents were asked to give reasons for their answers and these were categorised so that the surveys were comparable.

FIGURE 8.4 THE OPERATIONAL MODEL



An individual's total travel budget is comprised of three main components, travel time, queuing time and parking duration. Each of these is influenced by the behaviour of the respondents at various stages of their shopping trip. Travel time is influenced by the choice of destination, queuing time, by the respondents parking decisions, and parking duration, and by the respondents shopping behaviour. Data therefore had to be collected that would allow these components to be measured.

1. Travel Time

The travel time to the city centre is probably the easiest of these components to be measured because it is influenced primarily by the respondent's domicile. The questionnaire, therefore included a question on where individuals live. However, because this research has a temporal theme, respondents were also asked how long it took to travel from their homes to the city centre. There are problems inherent in basing the analysis on peoples' stated time since some individuals' perception of time is often inaccurate. However, by cross-tabulating domicile by travel time, it is hoped that such inaccuracies can at least be identified, if not erased. This data is available for all three surveys.

2. Queuing Time

This is a more complex component as it is influenced by the in-vehicle behaviour of the respondents which is comprised of a number of factors. Car park choice is obviously important as it reflects the respondent's major parking decision. All questionnaires were therefore coded according to which car park they were distributed in. The survey also asked respondents to give reasons for their choice. Four possible answers were available; easy to park, close to where they wanted to go, cheaper parking fee, and 'other', which they were asked to specify. These categories were tested in a pilot survey and were also directly comparable to data collected in the 'before' survey. The survey aimed to discover how satisfied people were with their choice of parking facility and asked if they had any trouble finding a car parking space. Respondents were also asked if they would have preferred to park elsewhere, if so where, and why they had a preference. All three surveys incorporated these questions. However the two later surveys also asked specifically how long it took the respondents to park on their arrival in the city centre. This measurement is the second major component of the respondents' total travel budget, i.e. queueing time. This section of the questionnaire concerning in-vehicle behaviour will identify any problems associated with car park provision, and by crosstabulating the data, the research will discover how long people are prepared to queue for a space before the wait becomes unnacceptable.

3. Parking Duration

The length of time a car is parked is influenced by car users' out-of-vehicle behaviour. In this research this is the respondents shopping behaviour. Shopping behaviour is a function of four main factors. Firstly the questionnaire needed to establish the purpose of the journey. There were six categories;

a) shopping

b) banks and building societies

c) council business

d) work

e) restaurants,cafes and pubs

f) other (to be specified)

These categories were tested in the pilot survey and also conformed to those used in the 'before' survey. The respondents could tick any number and combination of these. This research, however, is only concerned with shoppers. Respondents who combined shopping with banks and building societies, and restaurants, cafes and pubs were included. The analysis will distinguish two different types of shoppers. Respondents who listed shopping as a journey purpose, and those combining shopping and banks will be labelled as 'pure shoppers'. (Those listing banks are included because a trip to the bank is now an integral part of most shopping trips). 'Recreational shoppers' are those which may have listed both shopping and banks as their journey purposes but also included visits to restaurants, cafes and/or pubs. Those combining shopping with work, council business and 'other' journey purposes were included as a seperate category, 'other' because their parking duration would not necessarily reflect the proportion of that time spent shopping.

The questionnaire used in the first survey asked how many shops each respondent had visited and noted the names so that their geographic location within the city centre could also be recorded if necessary.

The two later surveys adopted a different approach and listed the most popular sixteen shops and asked the respondents to tick each one visited. Additional space was available for respondents to list other shops visited that did not appear on the form.

All the surveys included a question on how long each respondent parked his or her car.This question not only records the parking duration, the third major component of each person's total travel budget, but also allows individuals' shopping intensities (the number of shops visited per hour) to be calculated.

The questionnaires therefore contained questions that would give definite values for the three components of an individual's total travel time budget, but also collected information on the many factors that are hypothesized to influence them. The questionnaire used in the last survey can be found in Appendix 2.

8.5 The Sampling Procedure

As it would be almost impossible to gather data on the total car park-using shoppers visiting Plymouth city centre, it was decided to use a sample that would be representative of them all. The problems of deciding how large that sample should be, and what kind of sample to take are discussed here.

There are two basic ways of sampling; probability sampling and non-probability sampling. Probability sampling is often thought to be the superior method as it involves the random selection of respondents from a population. Non-probability samples are those selected on the basis of the researcher's judgement or convenience and are often taken from a particular group of the population. Probability sampling normally provides a bias-free method of selecting sample units and permits the measurement of sampling error (Green and Tull 1978). The main advantage of non-probability sampling is that it is cheaper to collect a large sample than with the probability method.

This research will use the non-probability convenience method of achieving a representative sample for two reasons. Firstly, the research required a large data base that would be comparable in size to the 'before' survey. Secondly, the questionnaire was targeted at a particular section of the population who were directly concerned with the subject under study. The inclusion of uninterested parties would therefore be avoided, maximising the possibility of achieving a high response rate.

The 'before' survey interviewed 1093 people as they returned to their cars at nine city centre car parks. The two later surveys aimed to get a similar number of questionnaires returned, with the same distribution across the car parks. A pilot survey was carried out in order to test the questions and to establish the likely response rate which would determine the number needed to be distributed. In the 'during' survey,the same nine car parks were surveyed, except for one which was no longer available after pedestrianisation, and a new car park was included , which had been open for one year. In the 'after' survey, a tenth car park was included which had been built to replace the on-street parking meters that had been removed when pedestrianisation was built. The car parks are of different sizes (Table 8.2), and are scattered around the city so that a good geographical coverage of the facilities was obtained (Fig 8.5). The pilot study indicated that a response rate of 36% could be anticipated. Accordingly, a total of 3328 questionnaires were distributed for the 'during' survey, and 3728 for the 'after' survey (400 more were distributed in an extra car park). This meant that 40% of the cars in each car park (based on the average occupancy over the previous twelve months), received a questionnaire.

There is a discrepancy concerning the days and months in which the survey was conducted. The 'before' survey was carried out on a Friday and Saturday in late January and early February 1985, the 'during' survey on a Thursday and Saturday in April, 1987, and the 'after' survey on a Friday and Saturday in early November 1988. These seasonal and daily variations will be taken into account when analysing the data. All surveys were carried out in the morning, between 1000 and 1200 midday.

Table 8.2 Capacity of All Car Parks Surveyed

Colin Campbell Court	274
Charles Cross	641
Derry's Cross	178
Guildhall	50
Mayflower West	698
Mayflower East	342
Marks and Spencer	87
Western Morning News	30
Woolworth East	50
Lockyer Street	665
Sainsburys	465
Western Approach	565

FIGURE 8.5

Plymouth City Centre
CAR PARKS

CHAPTER NINE

CHANGES IN BEHAVIOUR AND ATTITUDES OVER TIME

This chapter will examine how car users' behaviour and attitudes have changed over the study period. The analysis will mirror, as far as possible, the model illustrated in Fig 8.1. Firstly, Total Travel Budgets will be examined, followed by their components. Domicile, parking decisions and shopping behaviour will then be discussed. Lastly, socio- economic characteristics and attitudes will be examined.

9.1 Total Travel Budgets

The total travel budgets are comprised of the three components, travel time to and from the city centre from home, the queuing time at the car park and the time spent in the city centre (Fig 8.1). Total travel budgets are therefore evolved as below;

$$\text{total travel budget} = (\text{travel time} \times 2) + \text{queuing time} + \text{parking duration}$$

Comprehensive data is only available for the during and after surveys, as details of travel time and queuing time were not collected in the first survey.

A t-test was used in order to discover any significant changes between the during and after surveys. This revealed that the means for both surveys were very similar, 227.6 and 228.2, and the T value of -0.11 confirmed that no such differences were apparent (Table 9.1).

<u>TABLE 9.1</u> T-test on Total Travel Budgets Between During and After Surveys

	During (mean)	After (mean)	T Value	Significance
Total Travel Budgets	227.66	228.27	-0.11	0.912

The components making up the Total Travel Budgets were then examined, since the total travel budgets could mask underlying differences.

a) <u>Travel time</u>

T-Tests between the during and after surveys (data are not available for the before survey) revealed a T value of 3.17 indicating significant differences between the during and after surveys, with travel times being shorter in the after survey.

TABLE 9.2 T-test on Travel Time Between During and After Surveys

	During (mean)	After (mean)	T Value	Significance
Travel Times	26.06	22.63	3.17	0.002

b) Queuing time

Data are only available for the two latter surveys, and tests revealed no significant details between them. The means were 5.4 minutes for the during survey and 4.9 or the after survey.

c) Parking duration

Data are available for all surveys and T-tests indicate a very significant difference between the before and during surveys, (T value = -21.11) with respondents staying much longer in the during survey. No significant differences were found between the two later surveys (Table 9.3).

TABLE 9.3 T-test on Parking Duration Between Before and During Surveys

	Before (mean)	During (mean)	T Value	Significance
Parking Duration	95.18	170.81	-21.11	0.000

Although Total Travel Budgets themselves have shown no change during the study period, the analysis of the components of TTB has revealed some significant differences. The conceptual model hypothesised that people would want to stay longer in the city centre following pedestrianisation because of the improved environment, and this initial analysis suggests that this is the case since parking duration has increased significantly in the surveys carried out after the introduction of the scheme. Queuing times, which were thought to have been longer in the during survey because of the loss of parking facilities, have remained the same in the two latter surveys even though more facilities were available in the after survey. Travel times are shorter in the after survey.A number of factors could potentially influence travel times, including weather conditions, road improvements, and driver perceptions and characteristics. All of these are variable and ideally should be incorporated into the model. However, only limited details are available for this piece of work. The weather on all survey days was comparable, - slightly overcast with occasional light rain. There have been no major road developments or changes to the city centre infrastructure since the project's conception, apart from the pedestrianisation project. In this work the main factor influencing travel time is presumed to be domicile, and this and other component factors hypothesised to influence travel behaviour, will now be examined.

9.2 Component Factors

9.2.1 Domicile

All three surveys were examined to see if there were any significant changes in domicile and if any such differences could explain those already established between travel times in the last two surveys. Domicile was initially recorded as the village or town or part of Plymouth where each respondent lived, but this was recoded into four categories; inner Plymouth, outer Plymouth, other Devon and Cornwall and distant (Fig 9.1). Table 9.4 illustrates the frequencies for domicile for all three surveys, which show a similar pattern with most respondents in all surveys coming from other parts of Devon and Cornwall, and very few from Inner Plymouth.

FIGURE 9.1 PLYMOUTH ZONES

Table 9.4 Respondents' Domicile for all Three Surveys

	Before	During	After
	%	%	%
Inner Plymouth	1	1	1
Outer Plymouth	35	30	35
Other Devon & Cornwall	60	66	63
Distant Places	4	3	1

A Chi squared test was used to explore the data further. The null hypothesis was that there was no significant differences in domicile between the three surveys. However a chi squared value of 26.12 with 6 degrees of freedom suggested that the distributions were not random and that the null hypothesis could be rejected (Appendix 3.1). It would seem that in the before survey, fewer people came from other areas of Devon and Cornwall than would be anticipated, while in the during survey this category accounted for more than the expected number of respondents, with less originating from outer Plymouth. In the during survey it appears that there was a drop in the number of people visiting the centre originating from outer Plymouth, and this could reflect the fears at the time of this survey concerning the lack of parking facilities. The after survey revealed that fewer respondents lived in the more distant areas, with more from outer Plymouth. This supports the earlier observation that travel times were shorter in the after survey, and that there is a relationship between travel times and domicile. Chi squared tests examining domicile and travel time were performed on the during and after surveys and these confirmed a very strong correlation. The chi squared values of 729.13 and 864.24 respectively, with 18 degrees of freedom meant that both survey results were significant at all levels.

9.2.2 Parking Decisions

Although T- tests revealed no significant differences between queuing times in the two later surveys, it is essential to examine in more detail, the behaviour of respondents at the parking stage of their trip. This will allow insight into the decision making process and will identify any dissatisfaction with parking provision.

The actual choice of car park is important to this work with regard to the out-of-vehicle behaviour (shopping behaviour) of the respondents, however, the actual frequencies of car park use, only reflect the sampling and response rates of the survey. Actual car park choice will therefore be discussed in more detail when examining shopping behaviour.

The questionnaires asked a number of questions concerning respondents' parking decisions. Respondents were asked why they parked in their chosen car park, whether they would have preferred to park elsewhere and why, whether they had any trouble finding somewhere to park and whether the time limit (if any) was long enough.

Table 9.5 shows the reasons for choosing a car park for all three surveys.

Table 9.5 Reasons For Choosing a Car Park

	Before %	During %	After %
Easy To Find a Place	11	23	21
Close To Final Destination	85	67	72
Cheaper	1	6	5
Other Reasons	3	4	2

A chi squared test was used to explore the data further. The null hypothesis, that there would be no change in the reasons for parking in a particular car park for all three surveys was disproved. A chi squared value of 98.86 with 6 degrees of freedom indicated that the distribution was not random (Appendix 3.2). It would appear that in the before survey motorists primarily chose to park in a car park that would be close to their final destination. In the during survey, when there was a temporary drop in the number of parking facilities more motorists chose to park further away but in car parks that they perceived to be easier to access. This is still true but to a lesser extent in the after survey. In the last two surveys there is a rise in the number of people choosing to park where it is cheaper but this is probably due to the Sainsburys car park opened in 1987 which is free to Sainsburys's customers.

In order to ascertain how satisfied respondents were with the parking facilities in the city and how well the car parks were coping with the demand, several questions examining satisfaction with parking facilities were included on the questionnaire.

In the during and after surveys, respondents were asked if they had any trouble finding somewhere to park. The results, which showed no significant differences over time when tested, are summarised in Table 9.6.

Table 9.6 Did You Have Any Trouble Finding A Place To Park?

	During	After
	%	%
Yes	15	12
No	85	88

Respondents were also asked how long it took to find a parking space, (their queuing time). This has already been found not to have altered significantly, Table 9.7 illustrates that the majority of respondents parked in five minutes or less.

Table 9.7 Queuing Time

	During	After
	%	%
1 minute & under	36	42
2-5 minutes	40	38
6-10 mins	13	12
11-15 mins	4	4
16-30 mins	6	3
over 30 mins	1	1

Respondents were asked if they would have prefered to park elsewhere. Table 9.8 illustrates their response in all three surveys.

Table 9.8 Would You Have Prefered to Park Elsewhere?

	Before	During	After
	%	%	%
Yes	13	18	15
No	85	80	83
Don't Know	2	2	2

Although there are minor changes, notably in the during survey when dissatisfaction is highest, a chi squared test showed that there are no significant differences between the surveys.

If respondents had said that they wanted to park elsewhere, they were asked to give reasons; these are summarised in Table 9.9.

Table 9.9 Reasons for Preferring to Park Elsewhere

	Before	During	After
	%	%	%
Easy to Find a Space	16	4	7
Close to Final Destination	71	73	66
Cheaper	6	18	22
Other Reasons	6	5	5

The desire to park close to the ultimate destination is the chief reason for wanting to park elsewhere for all surveys. A chi squared test, however, disproved the null hypothesis that there were no significant differences in reasons between the surveys. A chi squared value of 27.65 with 6 degrees of freedom shows that there is strong evidence to suggest that the distributions are not random (Appendix 3.3). Although 'close to final destination' is the most frequently given reason in all surveys, there are significantly fewer respondents who wanted to park elsewhere because it was 'easy to find a space' in the latter two surveys. This could reflect the behaviour of respondents who have chosen to park further away from the centre in order to find a space, but who would prefer to have parked closer to their final destination. There is also an increase in the number of people who want to park at a cheaper location. It was thought that this was because of Sainsbury's opening, with free parking for their customers, but this does not appear to be so when respondents were asked where they would rather have parked (Table 9.10). Sainsburys was only mentioned by 5% of respondents in the after survey and by less than that in the during survey. It is more likely that the respondents who mentioned parking meters are those that wanted to park at cheaper locations.

Table 9.10 Where Would You Have Preferred to Park?

	Before	During	After
	%	%	%
Marks and Spencers	20	15	12
Woolworth	14	5	-
Mayflower East	12	-	-
Western Morning News	9	-	-
Mayflower West	7	-	-
Charles Cross	6	-	-
Parking Meters	-	20	20
Guildhall	-	6	-
Western Approach	-	5	-

Lockyer St	-	-	5
Sainsburys	-	-	5
Colin Campbell CT	-	-	4
Other	32	41	47
Base	121	192	193

(other= all other car parks mentioned and ranges from street parking to major car parks)

The table also reflects the changes in availability of the car parks in the city centre. Marks and Spencers is the most popular car park, probably because of its centrality. In the second two surveys 20% of respondents mentioned parking meters, although they had been instructed not to on the questionnaire. In the during survey in particular, respondents mentioned other car parks that were no longer available to them, such as Western Approach and the Guildhall. The non-availability of these preferred car parks is unsurprisingly the main factor for not using them, followed by the preferred car parks being full (Table 9.11).

Table 9.11 Why Didn't You Park There Today?

	During	After
	%	%
Not Available	49	48
Short Limit	6	9
Full	37	37
Other	8	6

The pattern in both surveys is almost identical. The third reason for not parking in the preferred car park was that the time limit was not long enough. However when all respondents were asked about the time limits, the majority were satisfied (Table 9.12).

Table 9.12 Was the Time Limit Long Enough?

	During	After
Yes	86%	88%
No	14%	12%

Parking decisions do not seem to have altered that much over the survey period. The conceptual model hypothesised that parking decisions would influence queuing times but this preliminary analysis offers little evidence to support this. This will, however, be discussed in more detail later in the thesis.

9.2.3 Shopping Behaviour

Shopping behaviour represents the out-of-vehicle behaviour of the car user when he or she has reached her destination. This work is predominantly concerned with those respondents whose main journey purpose is shopping, but all respondents will be included for the initial analysis.

All three surveys asked the respondents what places they had visited during their visit to the city centre. Multiple answers were allowed and consequently the results add up to more than 100%. The categories and results for all three surveys are illustrated in Table 9.13.

TABLE 9.13 What Types Of Places Have You Visited Since Your Car Has Been Parked Here?

	Before	During	After
	%	%	%
Shops	92	93	94
Banks & Building Socs	20	44	44
Pubs, cafes & restaurants	6	38	35
Council offices	4	6	5
Work	0	9	10
Other	4	9	9

Almost all car-bourne visitors to Plymouth carry out some kind of shopping during their trip in all surveys. More respondents are visiting banks and building societies in the later surveys and many more are visiting pubs, cafes and restaurants. Work was not categorised seperately in the before survey.

This research also needed to discover if there had been an increase in the number of shops people had visited during their visit. All surveys collected this information, but different methods were used. In the first survey, respondents were asked to list and name the shops they had visited. This resulted in a very large data base of retail outlets, most of which only visited by a very small proportion of the respondents. Analysis on this scale would have been very complicated and the results very confusing. Consequently it was decided that the more popular shops would be used for the analysis. Moreover, a geographical spread throughout the city was required. Seven shops were finally selected for the final analysis. The civic centre was also included to add a further dimension to the study.

The later two surveys used a more rigid format to collect the data. a list of sixteen shops was included in the questionnaire, and respondents were asked to tick the ones that they had visited. The seven shops from the before survey were included in the list, along with the next nine most popular shops. The addition of the extra shops was not considered to be an improvement to the research and it was decided, for reasons of comparability, that the original seven and the civic centre would form the data base for future analysis.

The shops were Marks and Spencers, Tesco, Coop, Debenhams, British Home Stores, Woolworths, and Habitat (Fig 9.2).

Table 9.14 shows the percentage of people visiting these stores for all three surveys.

Plymouth
City Centre

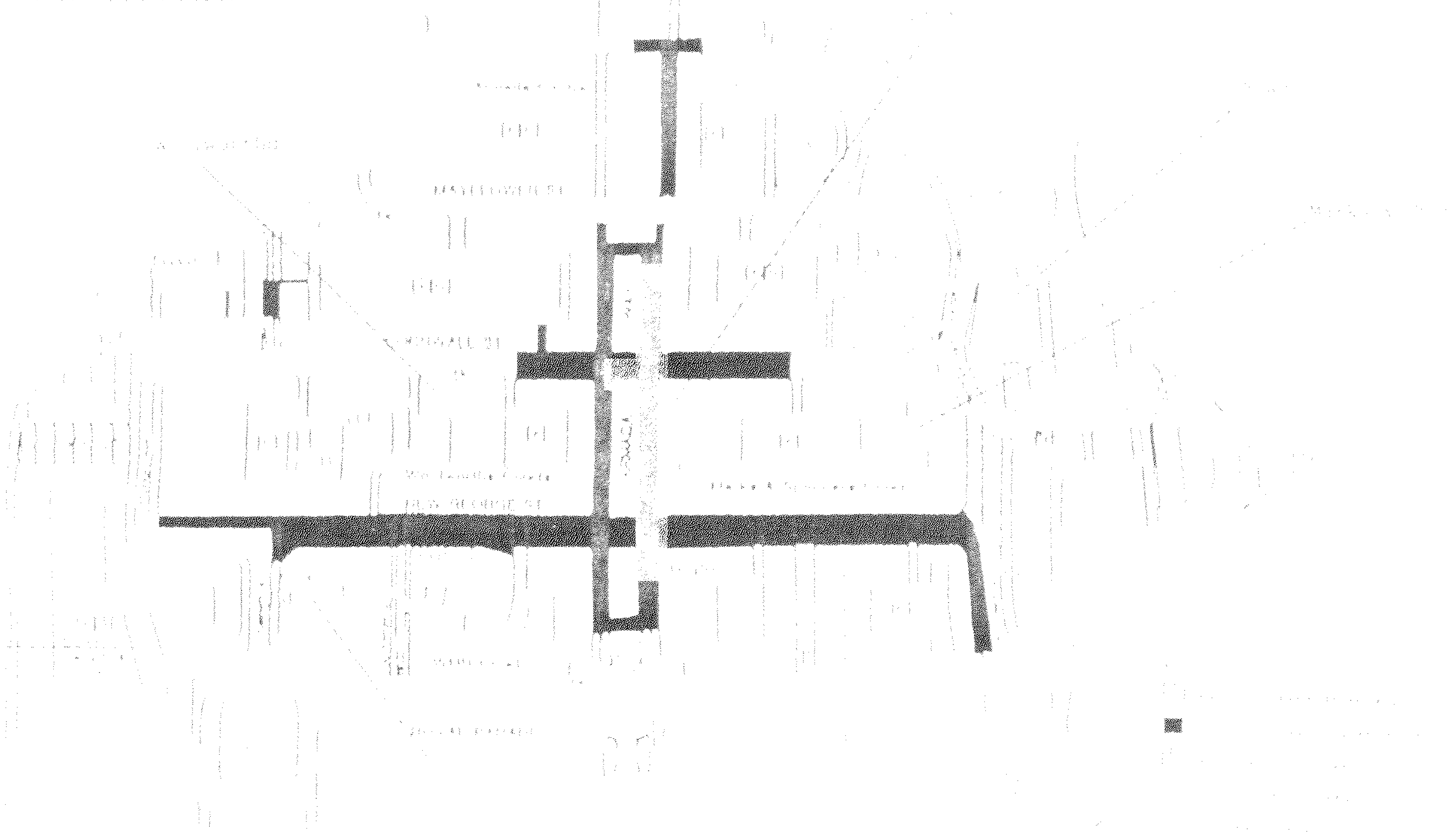


Table 9.14 Shops Visited

	Before %	During %	After %
Marks and Spencers	30	55	57
Tesco	17	14	14
Coop	16	26	34
Debenhams	13	39	39
BHS	12	34	36
Woolworths	11	37	35
Habitat	3	4	7

This clearly shows that there has been a significant increase in the number of people visiting these shops particularly between the surveys carried out before pedestrianisation and during its introduction.

The number of shops visited was also hypothesised to increase after pedestrianisation. Table 9.15 shows the frequencies and the percentages for each survey.

Table 9.15 Number of Shops Visited

	Before	%	During	%	After	%
1	433	58	265	28	322	27
2	236	32	255	27	296	25
3	63	9	191	20	265	23
4	9	1	141	15	147	13
5	5	-	70	7	92	8
6	-	-	15	2	35	3
7	-	-	9	1	16	1

There has clearly been an increase in the number of shops respondents are visiting following the introduction of pedestrianisation in the city.

The conceptual model suggests that there will be a difference in the shopping intensity between the surveys. Shopping intensity is the number of shops visited per hour and is based on the seven shops chosen for analysis. The hypothesis is that since pedestrianisation was introduced there will be a decrease in the intensity with which people shop, reflecting the more peaceful and pleasant environment in the city centre. Table 9.16 shows the shopping intensities for all respondents (except 'others') in all surveys.

Table 9.16 Shopping Intensities for all Surveys

	Before	During	After
	%	%	%
> 3 shops per hour	17	1	1
3 shops per hour	48	6	7
2.5 shops per hour	13	6	10
2 shops per hour	15	20	19
1.5 shops per hour	2	23	21
1 shop per hour	4	3	4
< 1 shop per hour	1	41	40

Clearly shopping intensities have decreased following pedestrianisation.

The conceptual model hypothesised that there are two different main types of shopper; the pure shopper who visit only shops and banks, and the recreational shopper who additionally may visit cafes, restaurants and pubs while conducting their shopping trip. The model hypothesises that once pedestrianisation has been introduced there will be more recreational shoppers using the city centre. Table 9.17 which shows the distribution of the two types of shoppers for all three surveys supports this.

TABLE 9.17 Type of Shoppers

	Before %	During %	After %
Pure Shoppers	80	45	48
Recreational Shoppers	6	31	29
Other City Centre Users	14	24	23

The conceptual model hypothesised that the improved city centre would encourage people to spend more time in the city centre, visiting more shops, and shopping at a lower intensity, i.e. that there would be an increase in recreational shoppers. The analysis has confirmed that this is the case following pedestrianisation. There are few differences between the during and after surveys, which would suggest that it was the actual introduction of traffic restrictions that influenced respondents' behaviour, since at the time of the during survey, environmental enhancement and landscaping and had not been started. Possible relationships between shopping behaviour and travel and parking behaviour will be explored in later chapters.

9.3 Socio-economic Characteristics

Socio-economic characteristics such as age, sex and occupation will be compared for all three surveys and any differences in distribution will be examined in the context of the study.

9.3.1 Age

Table 9.18 shows the distribution of ages for all three surveys.

Table 9.18 Age of Respondents

	Before	During	After
	%	%	%
under 25	10	12	7
25-34	22	26	24
35-44	27	30	27
45-54	17	16	17
55-64	15	11	15
65 and over	9	6	9

A chi square test carried out on the actual frequencies resulted in a chi squared value of 38.45, which with 10 degrees of freedom means that there is strong evidence to suggest that the distributions are not random (Appendix 3.4). Although the pattern is not all that clear, it would appear that the most obvious difference concerns the two older groups who seemed to have stopped visiting the city centre immediately after pedestrianisation was introduced, and then resumed their visits once the scheme was completed. This might be because of fears concerning the lack of access to the centre when the scheme was being built, which were discovered to be unfounded on the completion of the scheme.

9.3.2 Gender

A chi squared test revealed that there was a significant difference between the distributions for each survey (chi sq value of 21.93 with 2 degrees of freedom, Appendix 3.5). In the first survey there were more men than women, but this was reversed in the two later surveys. This may indicate the mens' reluctance to visit the city centre because of accessibility problems, reflecting their suspected higher values of time.

Table 9.19 Sex of Respondents

	Before	During	After
	%	%	%
Male	54	45	48
Female	46	55	52

9.3.3 Occupation

Data are only available for the last two surveys, Table 9.20 illustrates the results.

Table 9.20 Occupation of Respondents

	During	After
	%	%
Manager	21	7
Retail/clerical	24	22
Unemployed	1	1
Housewife	20	20
Student	2	1
Foreman/skilled	8	18
Retired	9	14
Unskilled	6	7
Armed Forces	5	4
Semi skilled	6	6

There has been a decrease in the percentage of managers visiting the city centre, possibly because of their higher values of time, and an increase in the percentage of foreman/skilled workers and retired people. Retired people are thought to have lower values of time than working people, and this might explain why more are visiting the centre after pedestrianisation. Why there should be more foremen and skilled workers visiting the centre is unclear.

There are several minor changes in the socio-economic characteristics of the populations between the three surveys, most of them may be explained in terms of values of time, for example, the reduction in male visitors and employer/managers to the city centre. The conceptual model hypothesised that socio-economic characteristics would influence respondents' behaviour, and Chapter 11 will examine this in more detail, and will aim to discover whether the changes identified in this preliminary analysis are significant.

9.4Attitudes Towards Pedestrianisation

In previous work conducted looking at the introduction of pedestrian streets, the public have normally been very much in favour of such schemes throughout their construction. In Plymouth, the introduction of peestrianisation was very controversial (Chapter 3), and attitudes towards it were diverse. Table 9.21 shows how public opinion changed from being very positive in the before survey, to very mixed in the during survey and again very positive after the scheme had been finished.

A chi squared test on the frequencies showed that there was a very strong indication that the distributions were not random (340.96 with 4 degrees of freedom, Appendix 3.6).

Table 9.21 Attitudes Towards Pedestrianisation

	Before	During	After
	%	%	%
In Favour	67	45	78
Against	28	37	14
Dont Know	5	18	8

Respondents were asked to give reasons for their answers in the last two surveys, and again a chi squared test on the frequencies suggested that there were significant differences at all levels of confidence (67.44 with 3 degrees of freedom, Appendix 3.7). Table 9.22 shows the percentages of people in each survey who gave the following reasons. (% do not add up to 100 because respondents could give more than one answer).

Similarly when the reasons for being against pedestrianisation were tested, the distributions were not random (Table 9.23). A chi squared value of 40.76 with 6 degrees of freedom means that the differences are significant at all levels of confidence (Appendix 3.8).

Table 9.22 Reasons For Being in Favour of Pedestrianisation

	During	After
	%	%
Safer	34	40
Easier to move around	59	46
Environmental reasons	30	60
Less congestion	3	2
Other	2	0

Table 9.23 Reasons for being Against Pedestrianisation

	During %	After %
Difficult to move around	19	26
Parking problems	44	42
Dont need it in Plymouth	12	12
Ghost Town atmosphere	25	4
Environmental reasons	10	13
Poor Traffic plans	18	17
Other	10	17

The reasons given for liking or disliking the scheme have changed according to the progress of the scheme. In the during survey, environmental reasons were only mentioned by 30% of the respondents who liked the scheme, but once the scheme had been completed this had risen to 60%, and had become the most popular answer. Of those respondents against pedestrianisation in the during survey 25% thought that the town had a 'Ghost Town Atmosphere', but only 4% mentioned this in the after survey. This is very likely an indication of the power of the media, which when pedestrianisation was introduced,carried banner headlines calling the city a 'ghost town'. Parking problems, however, remained the most popular reason for disliking the scheme even though replacement facilities had been built at the time of the after survey.

Attitudes have therefore changed considerably between the three surveys and because the conceptual model hypothesises that they are related to respondents behaviour, these changes could be of great importance to this research.

The analysis that has been discussed in this chapter has examined the changes in travel behaviour, parking decisions, shopping behaviour, socio-economic characteristics and attitudes towards the scheme during the research period. Many significant changes have been revealed particularly changes in the length of time people are spending in the city centre, their parking decisions and their attitudes towards the scheme. It would seem that the introduction of pedestrianiation caused many of the city centre users to modify their shopping and parking behaviour. The next stage of the analysis will examine the data for inter-relationships between the variables and this is discussed in the next chapter.

CHAPTER TEN

INTER RELATIONSHIPS BETWEEN THE COMPONENT PARTS OF THE MODEL

This chapter will examine the inter-relationships that exist between the component parts of the model. It has already been established that there are many significant changes in many of these over time, but it is now important to examine these changes with regard to other variables. The analysis will attempt to mirror the operational model illustrated in Fig 8.1, Chapter 8.

10.1 Travel Behaviour

Travel times have been proven to change between the during and after surveys (data are not available for the before survey), with travel times being shorter in the later survey. This research now needs to find out if there are any correlations between travel times and other factors.

10.1.1 Travel Time and Parking Duration

It has been suggested in the literature that long travel times will often result in longer visits. This work therefore hypothesises that travel time and parking duration will be positively related. Chi squared tests on the during and after data confirmed that there is strong evidence to suggest that the distributions are not random (chi squared values of 138.84 and 293.62, respectively with 30 degrees of freedom, Appendix 3.9, 3.10). When Kendall and Spearman coefficients were computed, these also confirmed a positive linear relationship indicating that longer travel times and longer parking durations are positively related.

10.1.2 Travel Time and Queuing Time

Theoretically there should be no relationship between travel times and queuing times, since the latter should be consistent for all city centre users. However previous research has suggested that people's perception of queuing or waiting times can be influenced by their other journey characteristics (Salomon 1986). For example if a respondent has a comparatively short travel time, the queuing stage of the journey may represent a high proportion of his or her overall travel time budget, and might therefore be perceived to be longer. Similarly respondents with high values of time might also overestimate their queuing time. In this research, however, no relationships were found.

10.1.3 Parking Duration and Queuing Time

A similar argument also applies to the possible relationship between parking duration and queueing time. This research, however hypothesises that there is no relationship between queuing times and parking duration. Chi squared tests on the during and after survey data confirmed this.

The next stage of the analysis is to examine the data for relationships between travel behaviour and parking decisions. Firstly it is necessary to examine the individual car parks themselves for their characteristics and to see if these have changed over time.

10.2Car Park Characteristics

10.2.1 Queuing Time and Car Park

By examining each car park in terms of the queuing times it is possible to identify those car parks which are more difficult to access. Again data are only available for the later two surveys.In the during survey, a chi squared test revealed strong evidence to suggest that the distributions were not random (chi value = 217.56 with 40 degrees of freedom). The easiest car parks to access, i.e those with the higher percentages of respondents saying that they parked within one minute, are Mayflower West, Derry's Cross and Lockyer Street. The worst car park in terms of queuing times is Charles Cross. In the after survey, which was also significant (chi value = 121.37 with 45 degrees of freedom) the newly re-opened Western Approach car park was quicker to access, followed by Lockyer Street, Mayflower West and Derry's Cross. These particularly Western Approach, are further away from the city centre and are consequently, not that popular. Again the poorest car park in terms of access times was Charles Cross.

10.2.2 Trouble Parking and Car Park

Respondents were asked if they had trouble parking, and these results were cross-tabulated with the individual car parks and tested with Chi squared tests. Similar results were anticipated as above, but there were only significant differences (50.99 with 8 degrees of freedom) in the during survey. Table 10.1 shows these results.

Table 10.1 Car Park by Trouble Parking

	YES %	NO %
Colin Campbell	27	73
Charles Cross	22	78
Derry's Cross	7	93
Mayflower West	7	93
Mayflower East	16	84
Marks and Spencers	31	69
Woolworths	24	76
Lockyer	6	94
Sainsburys	16	84

This partly confirms that already discovered by looking at queuing times, i.e. that Mayflower West, Lockyer and Derry's cross cause fewer problems, but the table suggests that Marks and Spencers is the car park where many people experience problems in accessing it. This is probably due to its popularity compounded by its relatively small capacity. The after survey revealed no significant results possibly because at the time of the survey, when more facilities had been built, there was less pressure on the central car parks.

10.2.3 Queuing Times and Trouble Parking

By cross-tabulating queuing time with trouble parking it is possible to find out what the generally accepted queuing time is. There is very strong evidence to suggest that significant differences relationships exist between these variables in both the during and after surveys (chi values of 621.03 with 5 degrees of freedom and 558.39 with 4 degrees of freedom respectively). The results show that a queuing time of up to five minutes is acceptable (Appendix 3.11, 3.12).

10.2.4 Prefer to Park Elsewhere and Car Park

Satisfaction with the car parks was further measured by the inclusion of the question 'would you prefer to have parked elsewhere'. This was crosstabulated with the car parks to find out if there were any patterns over time. In the before and after surveys this was not the case, but the during survey (when fewer facilities were available), there was a slightly significant relationship (Appendix 3.13). More people parking at Lockyer Street would have preferred to have parked elsewhere.

10.2.5 Time Limits by Car Park

Satisfaction was also measured in terms of the time limits imposed in several car parks. By cross-tabulating car parks by whether the respondent had sufficient time, it is possible to assess the supply of parking facilities. Data are not available for the before survey , but in the two later surveys chi squared tests revealed significant results.These results (showing similar patterns for both surveys) largely reflect the time constraints imposed on certain car parks in the city centre. Colin Campbell Court, Marks and Spencers and Woolworths all have time limits of two hours and these are where respondents feel the limit is insufficient. Car users parking at Sainsburys also considered that they had restricted time. This is probably because although there is no time limit, tariffs rise considerably after two hours, particularly if the car user does not visit Sainsburys itself. (Appendix 3.14, 3.15)

10.2.6 Parking Duration and Car Park

Car park choice was also examined in terms of the length of time each respondent spent in the city centre. Data from all three surveys were explored using chi squared tests with the null hypothesis that there would be no significant relationship between car park and respondents' parking duration. In all surveys this null hypothesis was disproved. The patterns in all surveys reflect the time limits imposed in certain car parks and the long stay facilities in others. Short limit car parks are Colin Campbell Court, Marks and Spencers and Woolworths, and the long stay facilities are Charles Cross, Derry's Cross, Lockyer, both Mayflower car parks and Western Approach. Sainsburys fits into neither category since although there is no limit as such, the tariff rises prohibitively after a couple of hours.

10.2.7 Reasons for Choosing Car Parks by Car Parks Used

In order to discover why respondents like particular car parks, they were asked why they preferred to park in their chosen car park. These results were cross-tabulated and chi squared tests were conducted with the null hypothesis that there would be no significant differences between car park and the reasons given for parking there. In all surveys, the null hypothesis was disproved. The results generally reflect the characteristics of the car parks: Motorists using Derry's Cross and Lockyer Street did so mainly because they were perceived to be easy to access, both Mayflower car parks and Marks and Spencers Court were used because of their location, close to car user's ultimate destination. Motorists using Sainsburys generally did so because of its cheapness.

10.2.8 Summary

It would appear that the car parks and their useage are reflections of their own individual characteristics. This research so far has enabled us to identify the most popular car park, Marks and Spencers, the one with the longer queueing times, Charles Cross, and those which are perceived to be easier to access, Derry's Cross, Mayflower West and Lockyer. It would certainly seem that to a certain extent, the more central and the smaller the car park, the longer the queueing times.

10.3 Relationships Between Travel Behaviour and Parking Decisions

Now with some knowledge of the car parks' characteristics it is possible to examine the car park decisions car users make and to see if there are any relationships between this and their other travel behaviour.

10.3.1 Travel Times and Car Park Choice

This analysis will examine if and how travel times might influence car park choice. This research hypothesises that there will not be a significant relationship between car park and travel time. However in both the during and after surveys there are significant results, but the after survey has the strongest relationship. This reflects the already confirmed relationship between travel time and parking duration, since the car parks with the longer time limits (Western Approach, Mayflower West and Charles Cross) have more than the expected number of respondents with longer travel times, and the car parks with limited time periods, such as Colin Campbell Court, Sainsburys and Marks and Spencer, have more respondents with shorter travel times.

10.3.2 Travel Times and Reasons For Choosing a Car Park

It was hypothesised that travel times may influence the reasons for wanting to park in particular car parks. For example, respondents with shorter travel times were thought to want to park close to their ultimate destinations as their total travel budget was more likely to be shorter, while respondents with longer travel times, thought to have longer time budgets, were hypothesised to park where it was easier, with less emphasis on proximity to final destination. The during and after surveys were tested (no data for before survey) but only the during survey revealed significant results, and these only at the 0.05 level of confidence.

10.3.3 Parking Duration and Reasons for Choosing a Car Park

Although travel times do not strongly influence the reasons for choosing a car park, parking duration does. The during and after surveys revealed that respondents parking in the city centre for one hour or less, chose to park in facilities close to where they want to go. Respondents staying between one and two hours chose cheaper parking facilities. However, motorists parking for longer periods did not as anticipated, park where it was perceived to be easier, but still showed a preference for parking close to where they wanted to go, although less so than the short-term parkers.

10.3.4 Travel Times and Satisfaction with Time Limits

There are no significant relationships between travel times and time limit satisafaction. It had been thought that respondents with longer travel times would want to stay longer in the city centre, requiring car parks with longer limits. These results suggest that if this is the case, the respondents select car parks without time restrictions.

10.3.5 Parking Duration and Satisfaction with Time Limits

There were significant results when parking duration was cross-tabulated and tested against time limit satisfaction in both the during and after surveys. However, it was not the respondents staying the longest in the city centre that were dissatisfied, but those staying between one and two hours. Most car parks with time limits restrict users to a two hour maximum stay and it would appear that many motorists find two hours too short for their visits.

10.3.6 Travel Time and Trouble Parking

Respondents with shorter travel times were hypothesised to be more critical of the delays in parking because queueing times would take up a higher proportion of their total travel budgets than respondents with longer travel times. However when this was tested no significant results were revealed.

10.3.7 Summary

The analysis has not revealed any strong indicators that either travel time or parking duration affect parking behaviour. However, the survey results suggest that respondents did give some thought to their parking decisions and chose car parks that were most ideally suited to their requirements.

The previous sections have examined travel behaviour, car park characteristics and parking decisions and the relationships between them. This section shall now examine shopping behaviour and will then go on to investigate any relationships between shopping behaviour, travel behaviour and parking decisions.

10.4 Shopping Behaviour

The conceptual model divides respondents into three groups, the pure shopper, the recreational shopper and others, who do not fit in either category. It has already been established that there are more recreational shoppers following the introduction of pedestrianisation. In this section the actual behaviour of these different types will be examined both for each survey and over time.

10.4.1 Shopper type by the number of shops visited

Data from all three surveys was examined to see if the different groups visited significantly different numbers of shops. Chi squared tests were used with the null hypothesis that there would not be any significant differences in distributions between the shopper groups. The test on the before data confirmed this hypothesis as no significant differences were discovered. However, in both the during and after surveys the null hypothesis was disproved. In the during survey, the chi squared test revealed a value of 46.19 which with 14 degrees of freedom was significant at all levels, and in the after survey even greater differences were discovered with a value of 84.66 with 14 degrees of freedom. These results mean that the null hypothesis can be rejected for the two later surveys. The pattern suggests that recreational shoppers tend to visit more shops than pure shoppers, who rarely visit more than three. The other group seem either to visit just one shop, or (especially in the after survey) more than six.

10.4.2 Shopper Type by Actual Shops Visited

This analysis will examine the actual shops visited in order to discover if certain shops are more popular with some groups than others. Thebefore survey shows that pure shoppers dominate the use of all sample shops, with over 80% of shop visitors coming from that category. Although pure shoppers still dominate the majority of the shops in the during and after surveys, this is to a lesser extent, and both recreational shoppers and other city centre users visit a fair number of shops. There does not appear to be any real differences in the distribution of the different city centre users between the actual shops.

10.4.3 Shopper Type by Shopping Intensity

The conceptual model hypothesises that the different shopper types will shop at different levels of intensity. Shopping intensity is the number of shops visited per hour, and it is thought that pure shoppers will shop most intensively. T-tests were carried out to explore this hypothesis. The before survey showed no significant differences between the types of shoppers. However, in both the during and after surveys significant differences were found between all three groups. In both surveys t-tests revealed that there were significant differences between the recreational and other city-centre users. In the during survey the T value was was -4.71 and in the after it was 5.65. (Tables 10.2 and 10.3)

Table 10.2 T-tests on Shopping Intensity Between Recreational Shoppers and Other City Centre Users (During)

	Recreational Shoppers (mean)	Other Users (mean)	T Value	Significance
Shopping Intensity	84.97	131.76	-4.71	0.000

Table 10.3 T-tests on Shopping Intensity Between Recreational Shoppers and Other City Centre Users (After)

	Recreational Shoppers (mean)	Other Users (mean)	T Value	Significance
Shopping Intensity	85.89	145.81	5.65	0.000

Similarly there were significant differences between recreational and pure shoppers in both the during and after surveys (4.94 and 5.16 respectively). Pure shoppers shop most intensively, then recreational shoppers, and the others shop at the lowest intensity, but this is because shopping only takes up a minor proportion of their total travel budgets.

10.4.4 Shopper Type by Day of Week

The conceptual model suggests that because of the different behavioural characteristics of the shopper types, the day of the week will be another differentiating factor. It is therefore hypothesised that pure shoppers will mainly be visiting the city centre on weekdays and that recreational shoppers on Saturdays. The remainder are also thought to be more in evidence on weekdays as the majority of these are thought to be people working in the city centre. In the first survey,although chi squared tests resulted in significant differences (chi value 29.90 with 2 degrees of freedom), these were not those that had been anticipated. Pure shoppers were found to be more in evidence on Saturdays, with recreational and other types visiting the city centre on weekdays.

In the during and after surveys, tests again found significant differences (41.13 and 72.08 with 2 degrees of freedom). However the results did not confirm the hypotheses. Other city centre users were found to be more likely to visit the city centre on weekdays, but both recreational and pure shoppers were both equally more likely to be visiting on a Saturday. (Appendix 3.16, 3.17, 3.18).

The strongest variables that differentiate between the three groups of city centre users are the number of shops visited and the shopping intensities, which confirms the hypotheses posed by the conceptual model. The research now needs to find out if these different groups display different travel and parking behaviour.

10.5 Relationship Between Shopping Behaviour and Travel Behaviour

The previous section has examined the relationships that exist between the type of city centre user and their shopping behaviour, this section will explore the relationships between travel behaviour and shopping behaviour.

10.5.1 Shopper Type and Total Travel Budgets

T-tests were used to examine the data for any possible differences in total travel budgets between different types of city centre user. In the during survey, when recreational and other city centre users (i.e. those who were categorised in neither of the two shopping groups) were compared, it was found that the 'others' had significantly (T value=4.58) longer budgets. Similarly when this group was tested against pure shoppers this was also the case but the differences were much greater (T value=9.82). The differences between pure shoppers and rereational shoppers were also significant (t value=8.26). Other city centre users therefore have the longest travel time budgets (mean=301.77), then recreational shoppers with a mean of 241.26, and pure shoppers have the shortest budgets with a mean of 180.25 (Table 10.4).

A similar pattern emerged when identical tests were conducted on data collected in the after survey. A t value of 4.39 resulted when recreational and other city centre users were compared, and a value of 11.50 was found when pure shoppers and others were tested. Differences were also evident when pure and recreational shoppers were tested (T value = 10.93). (Table 10.5).

Table 10.4 T-tests On Total Travel Budgets Between Different City Centre Users (During Survey)

	Recreational Shoppers (mean)	Other Users (mean)	T Value	Significance
Total Travel Budgets	241.26	301.77	-4.58	0.000

	Pure Shoppers (mean)	Other Users (mean)	T Value	Significance
Total Travel Budgets	180.25	301.77	9.82	0.000

	Pure Shoppers (mean)	Recreational (mean)	T Value	Significance
Total Travel Budgets	180.25	241.25	8.26	0.000

Table 10.5 T-tests On Total Travel Budgets Between Different City Centre Users (After Survey)

	Recreational Shoppers (mean)	Other Users (mean)	T Value	Significance
Total Travel Budgets	251.28	305.77	4.39	0.000

	Pure Shoppers (mean)	Other Users (mean)	T Value	Significance
Total Travel Budgets	176.10	305.77	11.50	0.000

	Pure Shoppers (mean)	Recreational (mean)	T Value	Significance
Total Travel Budgets	176.10	251.28	10.93	0.000

10.5.2 Shopper Type and Travel Times

Tests examining the travel times of recreational shoppers and other city centre users revealed no significant differences in either the during or after surveys. However there were significant differences between the pure shoppers and the other users in both surveys. In both the during and after surveys the t values were 2.67, the other city centre users having significantly longer travel times (Table 10.6). Recreational shoppers were found to have longer travel times than the pure shoppers in both surveys. In the during survey the t value was 2.77, and in the after, 5.39. (Table 10.7).

Table 10.6 T-test on Travel Times for Pure Shoppers and Other Users

	Pure Shoppers (mean)	Other Users (mean)	T Value	Significance
Travel Times (During)	22.68	29.57	2.67	0.008
Travel Times (After)	19.57	24.19	2.67	0.008

Table 10.7 T-test on Travel Times for Recreational and Pure Shoppers

	Recreational (mean)	Pure Shoppers (mean)	T Value	Significance
Travel Times (During)	28.36	22.68	2.77	0.006
Travel Times (After)	26.57	19.57	5.39	0.000

10.5.3 Shopper Type and Queuing Times

Queuing times are not really expected to differ between the user groups, and t-tests on the data for both the during and after surveys produced no significant results. It was felt that if differences were apparent they may be explained in terms of the groups differing perceptions of time.

10.5.4 Shopper Type and Parking Duration

Different user groups were expected to display different parking durations. It was hypothesised that pure shoppers would spend the shortest time in the city centre, then the recreational shoppers, followed by the other group which consists mainly of workers in the city. These hypotheses were confirmed when t-tests on both the during and after surveys revealed significant differences between the groups. In the during survey t-tests resulted in a t value of 5.30 when recreational and the other groups were compared. When recreational and pure shoppers were compared the t value was 9.49, and when the remainder and pure shoppers were tested, the value was 10.39. (Table 10.8)In the after survey the values were 5.64, 11.52 and 12.57 respectively.(Table 10.9).

Table 10.8 T-tests on Parking Duration Between Different City Centre Users (During Survey)

	Recreational (mean)	Other Users (mean)	T Value	Significance
Parking Duration	179.91	237.78	-5.30	0.000

	Recreational (mean)	Pure Shoppers (mean)	T Value	Significance
Parking Duration	179.91	129.41	9.49	0.000

	Other Users (mean)	Pure Shoppers (mean)	T Value	Significance
Parking Duration	237.78	129.41	10.39	0.000

Table 10.9 T-tests on Parking Duration Between Different City Centre Users (After Survey)

	Recreational (mean)	Other Users (mean)	T Value	Significance
Parking Duration	193.59	252.26	5.64	0.000

	Recreational (mean)	Pure Shoppers (mean)	T Value	Significance
Parking Duration	193.59	131.38	11.52	0.000

	Other Users (mean)	Pure Shoppers (mean)	T Value	Significance
Parking Duration	252.26	131.38	12.57	0.000

The results therefore confirm all the hypotheses, with the other group having the longest parking duration and travel times and consequently, longer total travel budgets, and pure shoppers having the shortest budgets.

10.6 Shopping Behaviour and Parking Decisions

Shopping Behaviour will now be examined to find out if there are any significant relationships with parking decisions.

10.6.1 Shopper Type By Chosen Car Park

The car parks surveyed have been shown to have certain characteristics that may make them more desirable to certain shopper types. The pure shopper, for example is hypothesised to require parking close to the ultimate destination and would not be concerned about any possible time limits. The recreational shopper, however is hypothesised to be less concerned about the location, but would require a longer time limit. The same applies to the other category. Chi squared tests on all surveys revealed significant differences between the car parks chosen and the type of city centre user.

The Chi squared test for the first survey was significant at all levels of confidence and showed that the other category tended to use the Guildhall, the Western Morning News, and Lockyer street car parks. This reflects their location and the lack of time restrictions, as the other category are known to have longer travel time budgets and are thought to consist mainly of people working in the city centre. Pure shoppers seem more likely to use the two Mayflower Street car parks, and to a lesser extent, Colin Campbell Court and Marks and Spencers Court. This again justifies the hypothesis since the Mayflower car parks are large and central to most of the town, and both Marks and Spencers and Colin Campbell Courts have short time limits and, particularly Marks and Spencers, are convenient for the central area of the city. Recreational shoppers, however do not seem to display any strong patterns and park evenly throughout the town, although there is evidence to suggest that Charles Cross is used more than others.

In the during survey, when the chi squared value of 66.94 with 16 degrees of freedom confirmed that car park choice was not random, a similar pattern is evident. Other users still predominate the use of Lockyer street, and are not found in the prime shopping car parks, particularly Sainsburys. Recreational users seem to be making use of the Mayflower car parks, and the pure shoppers dominate the users of Sainsburys and the smaller short term courts.

Similarly, in the after survey, again significant at all levels, (Chi squared value of 102.56 with 18 degrees of freedom), the other category tend to park in Lockyer Street and in the Western Approach car park following its reopening. Recreational users still dominate the use of the Mayflower car parks and pure shoppers, the Sainsburys car park.

10.6.2 Shopper Type by Reason for Choosing a Car Park

The type of activity respondents were engaged in during their visit to the city centre was hypothesised to influence their reasons for choosing particular car park. Pure shoppers were expected to require cheap parking close to their ultimate destinations, recreational users were expected to prefer facilities where it was easier to park, and other users were not expected to display any particular preference. All three surveys were tested using chi squared analysis, but only the during survey revealed significant results. The chi squared value of 25.88 with 6 degrees of freedom (a significance level of 0.0002) suggests that the distributions are not random. The hypotheses were reasonably accurate; recreational users tend to park where it is easier to find a space, pure shoppers where it is cheaper (but not close to their destinations as suggested). Other users, unexpectedly, did show strong preferences and liked to park close to where they wanted to go. (Appendix 3.19).

10.6.3 Shopper Type by Whether the Car Park Allowed Long Enough Parking

It has already been noted that different types of city centre users show preferences for different car parks, and it was thought that this was related to their time limits and their locations. Time restrictions in some of the smaller city centre car parks (Colin Campbell Court, Marks and Spencers Court, Woolworths) were not expected to affect pure shoppers as the restrictions were introduced to aid the turnover of short term shoppers. It was hypothesised that the recreational shoppers and the other city centre users would be those who were most restricted by the time limits. Both the during and after surveys (data are not available for the before survey), showed significant results when tested (Chi squared value of 11.37 in the during survey, and 6.66 in the after, with two degrees of freedom). The during survey results revealed that although the distributions were not random, the hypothesis was incorrect and that pure shoppers are those that are most inconvenienced by the time limits. In the after survey pure shoppers were still restricted by the time limits, but were joined by other city centre users (Appendix 3.20, 3.21).

10.6.4 Shopper Type by Trouble Parking

In the during survey, a chi squared test revealed a slightly significant relationship (6.66 with 2 degrees of freedom) suggesting that pure shoppers experienced the most problems parking, with the recreational shoppers being the most ambivalent (Appendix 3.22). The after survey, however revealed no evidence to suggest that the distributions were not random.

10.6.5 Shopper Type by Prefer to Park Elsewhere

When respondents were asked whether they would have preferred to park elsewhere, it was not the pure shoppers who were more likely to say yes, but the other city centre users, although only the after survey produced significant results (chi value = 39.36 with 4 degrees of freedom). It would seem that although the pure shoppers are more likely to complain about the facilities used, they are at least accessing the car parks that they require, but that they are dissatisfied with the facilities they offer in terms of spaces and time limits. Other city centre users also appear to believe that there is lack of facilities appropriate to their needs following the introduction of pedestrianisation (Appendix 3.23).

10.6.6 Shopper Type by Why Want to Park Elsewhere

The reasons given for wanting to park elsewhere help to explain what these short falls are. In the after survey (again the only one to show significant results with a chi value of 12.65 with 6 degrees of freedom), other city centre users wanted to park in facilities closer to where they want to go and at cheaper rates. Pure shoppers want facilities that are easier to access. (Appendix 3.24)

The results suggest that the different shopper types select the parking facilities most appropriate to their needs, but the respondents perceive there to be insufficient facilities to accommodate them. The other group, for example, generally park at long term car parks, but would prefer to park more cheaply closer to their final destination, and the pure shoppers who generally select central car parks want to park where it is easier to find a space. The analysis shows the perhaps obvious result, that respondents want cheap central car parks that are easy to access.

10.7 Summary

This chapter has revealed some interesting information, particularly about parking and shopping behaviour. Although there is no strong evidence to support the theory that travel time or parking duration influence parking behaviour, it has been noted that a longer travel time will often result in longer parking durations. Also, this work has discovered that a queuing time of 5 minutes or under for a parking space is acceptable to most city centre users. However, perhaps the most interesting information that has arisen from this work so far concerns the shopping behaviour of the car users.

The earlier chapter noted that there has been an increase in the number of recreational shoppers using the city centre and it is their shopping and parking behaviour that should be of interest to both retailers and planners. Recreational shoppers visit more shops than the other categories and stay longer in the city centre. Although this doesn't necessarily mean that they are spending more money, it does offer the retailers and shopkeepers plenty of opportunities to encourage these people to spend that time in their shops and therefore increase the likelihood of them making a purchase. In order to achieve this, some Plymouth shopkeepers may need to adopt a more imaginative approach to marketing and a stronger commitment to the pedestrianisation philosophy.

The during survey also noted that recreational shoppers had a more ambivalent attitude towards parking than the other city centre users. They were less concerned about being close to their final destination and wanted to use car parks where it was easy to park. This suggests that these recreational shoppers could be targetted for park and ride facilities , or other more peripheral parking sites.

More information is required to find out whether respondents travel, parking and shopping behaviour are linked to their socio-economic characteristics and their attitudes towards pedestrianisation. Chapter 11 will describe these inter-relationships.

CHAPTER ELEVEN

THE RELATIONSHIPS BETWEEN TRAVEL BEHAVIOUR, PARKING DECISIONS AND SHOPPING BEHAVIOUR WITH SOCIO-ECONOMIC CHARACTERISTICS AND ATTITUDES

This section will examine the socio-economic characteristics of the respondents in all surveys. It has already been established that there are relationships between travel behaviour, parking decisions and shopping behaviour, this part will now examine the data in order to find out if travel, parking and shopping behaviour are influenced by age,sex and occupation.

11.1 AGE

11.1.1 Travel Behaviour

i) Total travel budgets

No significant differences were found between the age groups in either the during or after survey. (data not available for the before survey).

ii) Travel time

It was hypothesised that age may be a significant factor in determining travel time. Elderly people may for example have shorter travel times reflecting a reluctance to spend too much time travelling. However tests on the data from all three surveys showed no significant patterns.

iii) Queuing time

It is not really thought that queuing times could possibly be different for different age groups, but it was thought that if there were any significant differences these could be interpreted as indications of differing time perceptions between the age groups. In the event there was a significant result when chi squared tests were conducted on the data collected in both the during and after surveys (chi squared values of 66.24 for the during survey and 74.60 in the after survey, with 25 degrees of freedom). It would appear that in both surveys the younger age groups (34 and under in the during survey, and 44 and under in the after survey) take significantly longer to park. Those over 55 did not seem wait so long. (Appendix 3.25, 3.26).

iv) Parking duration

Different age groups have been found in other studies to have different values of time. It was consequently hypothesised that age would be a differentiating factor in determining the length of time individuals would spend in the city centre. Younger people and older people are hypothesised to spend longer in the centre, with the middle age groups spending less time there.In the before and during surveys, this was not the case and chi squared tests revealed no significant differences. However in the survey conducted after pedestrianisation had been completed, a chi squared value of 66.57 with 25 degrees of freedom meant that there were significant differences at all levels (Appendix 2.27). Younger people are more likely to spend very long times in the city centre, and the older people tend to stay for shorter periods. The middle groups do not display any particular behaviour patterns.

11.1.2 Domicile

Domicile was not anticipated to be influenced by age, and no significant results were found.

11.1.3 Parking Decisions

i) Car Park Choice

The respondents choice of car park is thought to be influenced by their age. Younger people are hypothesised to be less concerned about the location of the car park, while elderly people would be expected to place greater emphasis on the closeness of the car park to their final destinations. All three surveys were tested for differences, and all were found to be significant. The patterns suggest that the younger age groups tend to park more at Lockyer Street, some distance away from the city centre, and Charles Cross (a multi-storey car park with no lift). The middle age groups are fairly evenly spread throughout the city centre but the oldest age group seem more likely to access the central car parks such as those on Mayflower Street and Marks and Spencers.

ii) Reasons for Choosing Car Park

It was hypothesised that older respondents would chose their car parks so that the ultimate destinations could be accessed and that younger age groups would be prepared to walk further and would chose car parks because of their ease of parking. However no significant results were found in any of the surveys, and these hypotheses were therefore rejected.

iii) Trouble Parking

It was hypothesised that there would be similar results to the relationships found when queuing times were tested by age, i.e. that younger people would perceive greater problems at the parking stage because of over estimations of the time spent queuing for parking spaces. However no significant results were found when data from the later two surveys were tested (No data available for Before survey).

iv) Prefer to Park Elsewhere

Younger people were hypothesised to be most discontent about the parking provision (for the same reasons as above). However only the during survey revealed significant results when tested and then only to the 0.005 level of confidence (chi value =26.20 with 10 degrees of freedom). Young people are more inclined to be dissatisfied, but the 45 - 54 year olds also register higher than expected levels of discontent. The 65 +year olds and the 25 - 34 year olds tend to be more likely to be satisfied.

v) Long enough time limits

In neither the during or after surveys (data are not available for the before survey), did age influence how people felt about the time limits in the car parks.

11.1.4 Shopping Behaviour

i) Type of shopper

It was hypothesised that there would be more very young and very old people in the recreational shopper category (as they are thought to have more time), that pure shoppers would be comprised of the middle age groups, and that the other category be comprised of a mixture of all age groups possibly with less from the older age groups. When data was tested from all three surveys, only the during survey revealed significant results. The chi squared value of 35.85 with 10 degrees of freedom meant that it was significant at the 0.0001 level of confidence. Table 3.28 in the Appendix illustrates that the hypothesis was reasonably accurate. Respondents between the ages of 25 and 44 dominate the pure shopping category, 45 to 64 year olds tend to be either recreational shoppers or in the other category. Younger respondents were found to be slightly more likely to be recreational users, but this is not conclusive.

ii) Number of shops visited

Only the during survey had significant results when a chi squared test was carried out. The Chi squared test was significant at all levels (Chi value = 79.13 with 35 degrees of freedom). However the only obvious pattern shows that younger people, under 34 are more likely to visit 2 shops.

iii) Actual Shops Visited

This analysis was thought to be able to identify the types of shops that certain age groups used and to see if there had been any changes over time. The majority of all customers to all of the seven sample shops were between the ages of 25 and 44, making up over 50% of the customers for all of them (except the Co-op, where they accounted for 47% of total customers. Five of the shops showed significant differences when customers age groups were tested over time. Only Tesco's and the Co-op registered no significant changes. It would appear that the same pattern is evident for all shops. In the during survey carried out before pedestrianisation was completed and before replacement parking facilities were built, there was a significant drop in the number of older customers and a parallel increase in the number of younger shoppers. This probably reflects the reduction in the number of older people visiting the city centre at this stage.

iv) Shopping Intensities

Older people were expected to shop at lower intensities than the middle age groups, who were known to dominate the pure shopper groups and were hypothesised to shop most intensively. Younger people were expected to shop at lower intensities reflecting the longer periods of time available to them. However when the data were tested none of the surveys revealed any significant results.

v) Day of Week

Elderly people were expected to shop during the week, while all other age groups were expecetd to be more likely to shop on Saturdays. All surveys were tested , but only those conducted after the introduction of pedestrianisation were significant. In the during survey a chi squared test resulted in a chi value of 51.65 with 5 degrees of freedom (Appendix 3.29). The under 34 year olds shopped mainly on a Saturday, while the other age groups, particularly the over 65s shopped during the week. A similar pattern was found in the after survey (chi value = 55.41 with 5 degrees of freedom, Appendix 3.30), with the elderly shopping during the week, however 54 year olds and under shopped mainly at weekends. The after survey therefore supports the hypothesis but the during survey only supports the theory that elderly people will shop on week days.

11.1.5 Attitudes

Attitudes towards pedestrianisation do not seem to be influenced by age in the before and after surveys, but in the during survey, a chi squared test revealed a value of 28.50 which with 10 degrees of freedom meant that there were significant results at the 0.0015 level of confidence (Appendix 3.31). It would appear that the 25 to 34 year olds are the most enthusiastic about pedestrianisation while all the other groups tend to be more critical, especially the older groups.

11.2 Gender

11.2.1 Travel Behaviour

i) Total Travel Budgets

It was hypothesised that women would have longer time budgets than men, based on the findings of several value of time studies. However when the data from the two later surveys were tested, no significant results were found.

ii) Travel Times

There are no significant relationships between sex and travel times in either of the two later surveys. (data are not available for the before survey).

iii) Queuing Times

It was hypothesised that men may tend to exaggerate their queuing times, reflecting their supposedy higher values of time, however analysis in this piece of research has shown that gender does not influence actual or perceived queuing times.

iv) Parking Duration

It was hypothesised that men would spend less time in the city centre than women. Chi squared tests revealed significant differences between the sexes in the before and after surveys, but not in the survey undertaken during the process of pedestrianisation. In the before survey it would appear that nearly half of all male respondents spend an hour or less in the city centre, while females tended to spend longer periods in the city centre (Chi squared value 25.53 with 5 degrees of freedom). In the after survey, when the results were significant at the 0.0013 level of confidence, this pattern had slightly changed. Apart from the fact that all respondents are now spending longer periods of time in the city centre, it would still seem that males are more likely to spend shorter periods there, with women generally taking longer over their trips. However there are significantly more men than women spending more than four hours in the city centre, but this probably reflects the more men working in the city centre. (See gender and shopping behaviour).

11.2.2 Domicile

Domicile was not thought to differ significantly for the different sexes, and tests confirmed this.

11.2.3 Parking Decisions

i) Car Park Choice

It was thought that gender may have an influence on car park choice, reflecting the differing values of time for each sex, but also reflecting the different design of car parks in the city, for example some of the multi-storey car parks are considered less safe for women than more open planned facilities. Only the data from the before data revealed significant results (51.82 with 10 degrees of freedom, Appendix 3.32). However the pattern is not that which was anticipated. It would appear that the location of the car park, rather than its design is the discriminating factor. Males are more likely to park in Lockyer Street and Derry's Cross, car parks which are more peripheral. Women seem to park in the more central car parks.

ii) Reasons for Choosing a Car Park

Despite the findings concerning car park choice (above), when the reasons for that choice were tested, there were no significant results for any of the surveys. It had been thought that men would be more likely to choose a car park that was easy to access, and that women would prefer those close to their final destinations.

iii) Trouble Parking

Men were hypothesised to be less content about the availability of parking facilities and this was thought to influence their answers. In the during survey, however no significant results were found, but in the after survey a chi squared test resulted in a significance level of 0.0008 (0.0006 before Yates correction), which suggests that men are more likely to complain than women. Table 11.1 shows the percentages.

Table 11.1 Trouble Parking By Gender

	% YES	% NO
MALE	15	85
FEMALE	9	91

iv) Prefer to Park Elsewhere

Although men were found to be less satisfied with the amount of time they spent queuing for a parking place, there were no significant differences between the sexes when they were asked if they would have preferred to park elsewhere.

v)Long Enough

This is another measure of the satisfaction of the parking facilities and it was hypothesised that women, who spend longer in the city centre shopping, would be those who were least satisfied with the time restrictions. Tests were carried out on the two later surveys (data are not available for the before survey) but only the after survey revealed significant results. The null hypothesis that there would be no difference between the sexes was disproved (chi squared value of 18.50 with 2 degrees of freedom) at the 0.0001 level of confidence and this confirmed that women did want longer time limits. Table 11.2 illustrates the percentages.

Table 11.2 Were The Time Limits Long Enough?

	YES	NO
	%	%
Male	92	8
Female	84	16

11.2.4 Shopping Behaviour

i) Type of Shopper

Because the pure shopping is strongly identified as fast and purposeful behaviour, it is thought that grocery shopping will constitute most of the shopping trip. Women are thought to conduct most of the grocery shopping, and for that reason, it was hypothesised that pure shoppers will consist mainly of women, and that men would be more likely to be recreational shoppers. It was also hypothesised that men would dominate the other category (consisting mainly of workers). When the data from all surveys was tested using Chi squared tests, only the two later surveys revealed significant patterns. In both surveys women easily the majority in the pure shopping category, and men the other category. However, in the during survey women were more likely to be recreational shoppers than men, but in the last survey the distribution of the sexes was more or less equal for this category.

ii) Number of shops visited

Men were hypothesised to visit very few shops while women were expected to visit more. In the before survey a chi squared test found no significant results, but in the two later surveys, significant results were found at 0.0001 level of confidence in the during survy, and 0.0000 in the after survey. In both surveys the hypothesis was found to be reasonably accurate; men tended to visit two or less, while women were more likely to visit between 3 and 4.

iii)Actual Shops Visited

The distribution of the sexes visiting the seven sample shops reflects the general distribution visiting the city centre. Over the three surveys women account for just over half of all customers, however BHS, Debenhams and Marks and Spencers have larger proportions of women, 60%, 58% and 59% respectively. Only the Co-op has more male customers, but then only fractionally (52%). Five of the shops showed significant changes in the distribution of customers over time, all showing a decrease in male patronage in the during survey. This reflects the overall drop in the number of men visiting the city centre.

iv) Shopping Intensity

Pure shoppers are expected to shop more intensively than the other two categories, and because more women have found to be pure shoppers, it is reasonable to hypothesise that women will shop more intensively thanmen. In the before and during survey, chi squared tests did not result in significant differences, however the chi squared test on the after survey revealed significant differences at the 0.0019 level of confidence. However the reverse of the hypothesis is true, and men are the most intensive shoppers. They either shop very intensively or very unintensively, the women generally shop at average levels.

v) Day of Week

Women are thought to shop more during the week, with men mainly visiting the city centre on Saturdays. This was true in the before and during surveys but no significant results were found in the after survey.

11.2.5 Attitudes towards Pedestrianisation

It was hypothesised that women would be more in favour of the scheme than men,for two reasons. It has been suggested in previous research that men have higher values of time than women, and because of that it was felt that they would be less tolerant of the increased problems of parking and the consequent time delays. Additionally women often have to take children shopping and the increased safety of the city centre would make the mothers more enthusiastic about the scheme. However, the after survey, the only one to produce significant results when tested, showed that the reverse was true and that men were actually more inclined to be in favour than the women (chi value of 16.72 with 2 degrees of freedom). Women are also more likely to be undecided. Table 11.3 illustrates the percentages.

Table 11.3 Do You Think Pedestrianisation Has Improved Plymouth's City Centre

	YES %	NO %	DON'T KNOW %
Male	82	14	4
Female	74	15	11

11.3 Occupation

Data on occupation was only available for the surveys carried out following the introduction of pedestrianisation.

11.3.1 Travel Behaviour

i) Total Travel Budgets

There were no significant differences in Total Travel Budgets between the occupational categories.

ii) Travel Time

No significant relationships were found between occupation and travel time in either of the surveys.

iii) Queuing time

Again there were no significant differences

iv) Parking Duration

In both the during and after survey, there were significant relationships between occupation and parking duration. Chi squared tests revealed values of 80.84 and 146.41 in the during and after surveys which meant that with 45 degrees of freedom, the tests were significant at the 0.0008 and 0.0000 levels of confidence. The most obvious patterns suggest that employers and managers and clerical and retail staff spend longer periods of time in the city centre, probably reflecting their working hours. Housewives spend two to four hours in the city, while other groups show no conclusve patterns. These findings reflect the shopper types in the city centre which shows that employers, managers and clerical and retail staff are more likely to be categorised as 'other' and Housewives tend to be pure shoppers.

11.3.2 Domicile

No significant results were found.

11.3.3 Parking Decisions

No significant results were found.

11.3.4 Shopping Behaviour

i) Shopper Type

The chi squared tests on occupation and shopper type were significant at all levels for both the during and after surveys (Chi squared values of 56.62, and 66.26 respectively, with 18 degrees of freedom). The pattern for both shows that clerical/retail staff are more likely to be categorised as other, while housewives are most likely to be pure shoppers. In the after survey, managers and employers are also seen to be heavily classified as other.

ii) Number of shops visited

No significant relationships were evident between occupation and the number of shops visited.

iii) Actual Shops Visited

No Significant relationships were found.

iv) Shopping Intensity

No significant relationships were found.

v) Day of the Week

The day of the week was significantly related to occupation in both of the surveys. Again it was the clerical/retail workers, the housewives and the retired with the most strongly determined behavioural patterns. Clerical and retail workers were more likely to visit the city centre on Saturdays (presumably they were working on these days) along with retired people. Housewives visited the city centre mainly on weekdays.

11.3.5 Attitudes

Occupation showed no significant relationships with attitudes towards pedestrianisation.

11.4 ATTITUDES

In this section attitudes towards pedestrianisation were examined to find out if there were any significant relationships with car users's travel,parking and shopping behaviour. All three surveys were tested, but in the before survey, attitudes showed no relationships to any of the other variables. For this reason, this section will concentrate on the during and after surveys.

11.4.1 Travel Behaviour

i) Total Travel Budgets

No significant relationships were found.

ii) Travel Time

Only the after survey resulted in significant results when attitudes and travel times were tested. A Chi squared value of 23.83 with 12 degrees of freedom suggested that people in favour of the scheme were most likely to have travelled for 10 and 30 minutes, while those travelling for between 5 and 10 minutes were more likely to be against pedestrianisation.

iii) Queuing Time

Both surveys revealed strong relationships between attitudes and the time respondents queued for parking facilities. The chi squared tests revealed similar patterns (62.96 and 17.99 with eight degrees of freedom, Appendix 3.33, 3.34). Respondents were more likely to be in favour of pedestrianisation if their queuing time was 5 minutes and under, and more likely to be against the scheme if the queuing time was longer. The during survey, when there were less parking facilities and the scheme was incomplete showed a much stronger relationship.

iv) Parking Duration

The during survey revealed significant results (chi value of 31.51 with 10 degrees of freedom) which suggest that respondents staying longer in the city centre are more likely to be in favour of the scheme. Respondents with shorter parking durations were less inclined to be in favour. The after survey, however revealed no significant results when tested.

11.4.2 Domicile

Since travel times and domicile are known to be related, it was anticipated that a similar pattern would emerge to when travel times and attitudes were tested. However, although the after survey did have significant results, the pattern was not the same. Respondents from outer Plymouth were found to be least likely to be in favour of the scheme, but these people are more likely to be those travelling between 10 and 30 minutes. When travel times and attitudes were tested , it was the respondents travelling for between 10 and 30 minutes who were found to be most in favour of pedestrianisation. It is not possible to explain this apparent discrepancy.

11.4.3 Parking Decisions

i) Car Park Choice

No significant results were found when attitudes and choice of car park were tested.

ii) Reasons For Choosing a Car Park - Only the during survey showed significant results. Although the most popular reason for choosing a car park for all respondents was 'close to where I want to go', Appendix 3.35 suggests that those in favour of pedestrianisation are more inclined to chose car parks that are easier to access, while those disliking the scheme continue to chose car parks that are close to their final destinations. This could reflect how those in favour have come to terms with the drop in accessibility, whereas the others have not.

iii) Trouble Parking

Because of the strong relationship found between queuing times and whether people felt they had had trouble parking and because of the significant relationsip found between queuing times and attitudes (above), it was hypothesised that people who experienced problems at the parking stage of their trip would be more likely to dislike the pedestrianisation scheme. this was found to be true in both the during survey and the after survey. (Appendix 3.36, 3.37).

iv) Prefer to Park Elsewhere

Similar results were found when the relationships between attitudes and whether people had wanted to park somewhere else were examined. Both survey results proved significant (chi values 84.90 and 89.06 with 4 degrees of freedom), and the patterns in both were identical (Appendix 3.38, 3.39). If respondents had wanted to park in an alternative car park, they were more likely to dislike the pedestrianisation scheme.

v) Long Enough

Again in both surveys there was a link between dissatisfaction with the level of service and attitudes. Those individuals who felt that the time restrictions were too short, were more likely to dislike the scheme.

11.4.4 Shopping Behaviour

i)Type of Shopper

It has aready been found that after pedestrianisation was introduced, more recreational shoppers used the city centre. It was thought that the new city centre attracted more of these shoppers and that people had changed their behaviour in response to the more leisurely pace of the city. It was therefore hypothesised that the recreational shopper would be most likely to be in favour of the scheme, and that pure shoppers and those respondents in the other category, would be less enthusiatic. In the during survey tests revealed no significant results, however results from the after survey were slightly significant (chi value 9.80 with 4 degrees of freedom) and suggest that the hypothesis was true and that recreational shoppers are more inclined to be in favour of the scheme. Pure shoppers appear to be the most ambivalent, while other city centre users are much more likely to dislike the scheme (Appendix 3.40).

There were no significant differences between between the number of shops visited, actual shops visited, shopping intensity, or day of the week with attitudes towards pedestrianisation.

11.4.5 Socio-economic Characteristics.

i) Age

It has already been discovered that age is a significant factor with regard to attitudes; 25 to 34 year olds are most likely to be enthusiastic, while 35 to 54 year olds are more likely to be critical.

ii) Gender

Results (previously discussed) suggests that men are more inclined to be in favour (for the after survey only).

iii) Occupation

Occupation has aready been found not to have any relationship with attitudes towards pedestrianisation.

11.5 Summary

This chapter has examined the data in order to find out if socio-economic and attitude variables show any relationship with car users' behaviour.

The age of the respondents did not seem to affect their actions, although younger people appear to spend more time in the city centre. There was also some evidence to suggest that age influenced the car parks used, with older people seemingly preferring the more central car parks.

The gender of the respondents showed more relationships with behaviour. Women generally spent longer in the city centre, and wanted longer time limits in the car parks, although it was the men who were more likely to complain about parking facilities. The pure shopper category consisted mainly of women, although women tended to visit more shops than the men. In the during survey there were more women than men in the recreational category, although this evened out in the after survey. The occupational categories of the respondents revealed only predictable relationships with shopping behaviour; housewives tended to be pure shopper and spent two to four hours in the city centre while clerical and retail staff were more likely to be categorised as 'other' and spent longer in the city centre.

Respondents' attitudes towards pedestrianisation showed no significant relationships with any of the other variables in the survey undertaken before the scheme was introduced. However, the latter two surveys provided interesting results. Car users with short travel times were found to be more likely to dislike pedestrianisation. Respondents with queuing times of more than five minutes were also more critical, with the during survey, when parking was a major issue, showing the strongest relationship. Respondents staying for longer periods of time in the city centre were found to have generally favourable attitudes towards the scheme, but this was only significant in the during survey. Attitudes towards pedestrianisation, however, showed the strongest relationships with respondents parking experiences and perceptions. Respondents who said they had trouble finding a place to park, or who would have preferred to park elsewhere, and those who wanted longer time limits in the car parks were all more likely to dislike pedestrianisation.

These results clearly suggest that parking is an important stage of a trip to the city centre and that if car users encounter any problems at this stage, then their attitudes towards pedestrianisation will be more critical. These results also indicate how influential local papers and television companies can be. The media constantly stressed the problems of parking following pedestrianisation, and although this research has found no significant evidence to support this, many car users obviously perceived parking to be a problem.

CHAPTER TWELVE

A MORE DETAILED LOOK AT CAR USERS' SHOPPING BEHAVIOUR AND ATTITUDES

12.1. Introduction

The previous chapters have examined and illustrated the main changes in car users' travel, parking and shopping behaviour and attitudes towards pedestrianisation over the three survey period. The chapters have also identified several inter-relationships that existed between individuals' behaviour and attitudes. Changes were found in all three components of the total travel budget (TTB), although changes in the TTB between the two latter surveys (data not available in the first) were minimal. Travel time was shown to differ between the two later surveys with travel times shorter in the last survey. Queuing times, however revealed no significant changes. Changes in parking duration were very significant between the first survey before pedestrianisation and those carried out after the scheme was implememted with respondents staying much longer after pedestrianisation. Parking duration is influenced by the behaviour of the car user while he or she is out of his or her vehicle, and because parking duration was found to have shown the most significant differences between the before and after surveys, this second part of the analysis will examine car users' shopping behaviour in more detail. Additionally, another of the more significant changes found in the previous chapter concerned the attitudes respondents had towards the pedestrianisation scheme. These were found to have fluctuated considerably during the three survey period. Attitudes were also found to be significantly related to a number of other variables. It was therefore felt that this part of the research area also required additional investigation. This chapter will therefore examine in more detail shopping behaviour and attitudes towards pedestrianisation in Plymouth.

12.2 Shopping Behaviour

All respondents have been categorised into one of three groups. These have already been described earlier in the thesis, and are pure shoppers, recreational shoppers and others. The previous chapter has revealed that there are significant relationships between the type of shopper and other variables. These include travel and parking behaviour, socio-economic characteristics, attitudes as well as their actual shopping behaviour. The next part of the analysis aims to discover which of these variables is the most important in determining the type of shopper a car user will be.

It was decided that Discriminant Analysis would be the optimal tool in order to explore the data. The concept of this type of analysis is reasonably straightforward; the analysis derives linear combinations of the predictor variables which then serve as a basis for allocating each case into one of the shopper groups. The analysis results in a classification table that indicates how successful the predictor variables are in discriminating between the two groups of shoppers. If the result is purely random 50% of the cases would be correctly classified. The higher the correct classification the better the predictor variables are at discriminating between the two groups. Classification rates of 80% and over are generally regarded as good results. In this research although such high results would be welcomed, it is the ranking of the predictor variables in order of their powers of discrimination that are of main interest and how these may or may not differ between the three surveys.

In order to gain the information required for this research, a stepwise selection method was used. In a stepwise selection method the variable with the highest acceptable value for the selection criteria is the first to be entered into the model. After that the all other variables not yet in the model are evaluated for selection and the one with the highest acceptable criterion is entered into the model. The variable already in the model is then re-evaluated to find out if it meets the removal criterion, i.e. whether it is no longer needed to contribute to the classification of cases, if it does meet the removal criterion it is removed. The selection criterion in this research will use the minimisation of the Wilks lambda. This (also known as the U statistic) can be between 1 and 0, a lambda of 1 occurs when the observed group means are equal, while values closer to 0 indicate greater differences between the groups. The number of steps in the model can be twice the number of predictor varibles used, or less if desired.

Discriminant analysis will be used to examine the data for differences between:

1. Pure and recreational shoppers
2. Recreational shoppers and other city centre users
3. Pure shoppers and other city centre users

All three surveys will be used in the analysis so that comparisons can be made at different stages of the pedestrianisation schemes development.

12.2.1. Pure and Recreational Shoppers

In the before survey, the predictor variables were day of week, car park used, domicile, attitudes towards pedestrianisation, parking duration, age, sex, and number of shops visited. These variables were used because they had all proved significant in earlier tests.Shopping intensity was also included, because, although it is comprised of variables also included in the model (i.e parking duration and no. of shops visited), this research aims to find out which variables are the most important, and needed to find out in which order they were selected for entry into the model. Table 12.1 shows the variables that were included in the model, and the order in which the variables were entered into the model. The Standardised Canonical Discriminant Function Coefficients, which indicate how strong each variable is in predicting group membership, are also shown.

Table 12.1 Variables Discriminating Between Pure and Recreational Shoppers Before Pedestrianisation.

Variable	Standardised Canonical Discriminant Function Coefficients
1. Parking Duration	- 0.68513
2. Day of Week	0.53620
3. Age	0.45510
4. Domicile	0.30598
5. No. of Shops Visited	- 0.26244

Table 12.1 shows that parking duration is the first and the strongest variable discriminating between the two shopper groups. Day of the week was the second variable to be entered into the model with age entered third. The values of the canonical discriminant functions are however fairly low which indicates that none of the variables were that good at predicting group membership, and this is confirmed in Table 12.2 which shows the classification rates. Further analysis was carried out without including the shopping intensity variable, very little differences were observed, with the same variables included in the model, with similar SCDFCs and an identical classification rate.

Table 12.2 Classification Summary (Before Pedestrianisation)

	No. of Cases	Predicted Group Membership	
		Pure	Recreational
Pure Shoppers	856	542	314
		63%	37%
Recreational Shoppers	52	19	33
		36%	64%

Percent of Grouped Cases Correctly Classified = 63%

In the later two surveys after pedestrianisation, similar variables were used as predictor variables, although more were included because more were collected in the during and after surveys. These were; day of week, domicile, car park, travel time, whether respondents had trouble parking, parking duration, attitudes, occupation, age, sex, and number of shops visited. Again, in order to find out which were the strongest predictor variables, shopping intensity was included, along with total travel budgets, although they are comprised of other variables in the analysis. Again as with the before survey, only a few of these were actually entered into the model (Tables 12.3 and 12.4).

Table 12.3 Variables Discriminating Between Pure and Recreational Shoppers During Pedestrianisation

Variables	Standardised Canonical Discriminant Function Coefficients (SCDFC)
1. Parking Duration	0.82778
2. Age	0.24042
3. Shopping Intensity	0.25259
4. Car Park	0.16766
5. Occupation	0.12921

Table 12.4 Variables Discriminating Between Pure and Recreational Shoppers After Pedestrianisation

Variables	SCDFC
1. Parking Duration	0.73808
2. Sex	- 0.11849
3. Total Travel Budget	0.27722
4. Age	0.0990

These tables show that like the Before survey, the most important variable discriminating between the two shopper groups is parking duration. The SCDFC for parking duration in both of the two later surveys is very high, and although other variables were entered into the model their SCDFCs are very low indicating a very low contribution towards the discriminant function. The SCDFC for parking duration in the two later surveys are much higher than in the before survey and this has resulted in an improved group membership prediction (Tables 12.5 and 12.6).

Table 12.5 Classification Summary (During Pedestrianisation)

	No. of Cases	Predicted Group Membership	
		Recreational	Pure
Recreational Shoppers	347	219	128
		63%	37%
Pure Shoppers	495	141	354
		28%	72%

Percent of grouped Cases Correctly Classified = 68%

Table 12.6 Classification Summary (After Pedestrianisation)

	No. of Cases	Predicted Group Membership	
		Recreational	Pure
Recreational Shoppers	398	221	171
		55%	45%
Pure Shoppers	643	148	495
		23%	77%

Percent of Grouped Cases Correctly Classified = 69%

When the same analysis is carried out omitting the shopping and total travel budgets, (so there is no duplication of variables), there are slightly different results. In the during survey, parking duration is still the first variable to enter the model and has the highest SCDFC. Age is the second variable to be entered, and while shopping intensity was the third to be entered in the previous analysis, the number of shops is third when shopping intensity is not included. The SCDFC are nearly identical. The car park used is still the fourth to be entered, but trouble parking is now entered at the fifth step instead of occupation. The overall classification rates are also affected; in the analysis omitting shopping intensity and total travel budget, only 66% of cases were correctly classified, a reduction of 2%. It would appear that the inclusion of duplicate variables aids the classification, but only to a limited extent. This is also true in the after survey, although to a lesser extent. The same variables were entered into the model in the same order, except for total travel budget which was replaced by travel time. The overall classification rate was, however, unchanged.

The tables above illustrate that pure shoppers are most likely to be correctly classified, and this group must have more easily identifiable characteristics. The analysis for all surveys has shown that parking duration is the most discriminting factor between pure and recreational shoppers with recreational shoppers spending much longer in the city centre.

12.2.2 Recreational Shoppers and Other City Centre Users

The differences between recreational shoppers and other city centre users are more exaggerated than those found between pure and recreational shoppers. The same predictor variables were used as before and all three surveys had higher percentages of correctly classified caes. In the Before survey, although only two of the predictor variables were included in the model, (no. of shops and domicile), 70% of cases were correctly classified. The Standardised canonical discriminant function coefficient (SCDFC) was highest for no. of shops visited (0.94933) with Domicile -0.33173. Clearly the number of shops visited discriminates between the two shopper categories very strongly.

The during and after surveys also achieved similarly high correct classifications, 72% and 70% respectively. However, while in the before survey, only two predictor variables were included in the model, both of the two later surveys used more variables to reach this classification rate (Tables 12.7 and 12.8)

Table 12.7 Variables Discriminating Between Recreational Shoppers and Other City Centre Users During Pedestrianisation.

Variables	SCDFC
1. No. of Shops	1.06742
2. Parking Duration	- 1.40209
3. Day of Week	0.51459
4. Shopping Intensity	- 0.67487
5. Trouble Parking	0.29746
6. Sex	0.22038
7. Total Travel Budget	0.64986
8. Domicile	- 0.26277
9. Car Park	0.10397
10. Age	- 0.10280

Table 12.8 Variables Discriminating Between Recreational Shoppers and Other City Centre Users After Pedestrianisation

Variables	SCDFC
1. Day of Week	0.58264
2. Parking Duration	-0.83986
3. No. of Shops Visited	0.93289
4. Shopping Intensity	-0.84287
5. Travel Time	0.34030
6. Trouble Parking	0.13174
7. Attitudes	-0.15510
8. Sex	0.20339
9. Occupation	0.17443
10.Domicile	-0.13315

In both surveys, the first four predictor variables to be entered were the same (No. of shops visited, parking duration, day of week and shopping intensity), although in slightly different orders. In the during survey, although the number of shops visited was entered first, the SCDFC for parking duration indicates that this is the variable that contributes most to the discriminant function. Similarly, in the after survey, day of week is entered first, but the strongest predictor variable is shopping intensity, closely followed by parking duration. The remaining predictor variables included in the models contribute to the discriminant function in a much more limited way, with the exception of total travel budget in the during survey. Although the SCDFC are an important indicator of a variables strength in predicting membership, it is not uncommon for the variable with the highest SCDFC to be entered at a later step in the model. This is because the analysis is evaluting all the variables included in the model and the combination of variables affects both the order in which they are added and the final SCDFCs.

When analysis was conducted omitting the shopping intensity and total travel budget, slightly different results were achieved. In the during survey the first three variables to enter the model were the same but the classification results were slightly reduced, down to 70%. Again, in the after survey, the first three variables to enter the model were the same, with variations occurring only later in the model. The classification rate was also reduced to 68%.

For all three surveys the number of shops visited is an important predictor variable confirming that recreational shoppers are more likely to visit more shops than other city centre users. Parking duration is important in the two later surveys, with other city centre users parking for longer periods, mainly because most of them are working in the city centre.

12.2.3 Pure Shoppers and Other City Centre Users

The differences between pure shoppers and other city centre users were expected to be highly significant because it has already been discovered that pure shoppers minimise the time spent in the city centre and other respondents , normally city centre workers, spend longer periods there. Although the high percentage of cases correctly classified reflect significant differences between the two user groups, the predictor variables were not always entered into the model in the order that was anticipated.

In the before survey, when the analysis resulted in 71% of all cases correctly classified, the first and the strongest predictor variable to be included into the model was the number of shops visited (Table 12.9), while parking duration was only entered at the fourth step, with only the third strongest SCDFC.

Table 12.9 Variables Discriminating Between Pure Shoppers and Other City Centre Users Before Pedestrianisation

Variable	SCDFC
1. No. of Shops	0.61717
2. Car Park	-0.34346
3. Day of Week	0.47304
4. Parking Duration	-0.37446
5. Sex	0.27966
6. Age	0.25063
7. Domicile	-0.17569

The last three variables to be entered into the model, sex, age,and domicile, contribute little to the discriminant function. When shopping intensity was removed from the analysis, the change in the results was minimal, with all the variables being entered at the same stages with only slightly different SDDFCs, and no change in the classification rate.

Analysis of the during survey, which resulted in 77% of cases correctly classified, clearly showed parking duration to be the most important predictor variable. It was the first to enter the model and has the highest SCDFC (Table 12.10).

Table 12.10 Variables Discriminating Between Pure Shoppers and Other City Centre Users During Pedestrianisation.

Variables	SCDFC
1. Parking Duration	-0.87215
2. Day of Week	0.37873
3. No. of Shops Visited	0.38124
4. Age	-0.27538
5. Car Park	0.17648
6. Sex	0.17199
7. Trouble Parking	0.08164

Almost identical results were achieved when shopping intensity and total travel budgets were omitted from the analysis.

The last survey also reveals a similar pattern although many more variables were entered into the model. Table 12.11 (below) shows the variables which were included which resulted in a correct classification of 78% of cases.

The first predictor variable to be entered for analysis, was, like the during survey, parking duration, followed by day of the week. However, in the after survey, parking duration was removed at a later stage. This occured after the total travel budget was entered at stage 7. The inclusion of the total travel budget, which is made up from other time variables, including parking duration, has made the parking duration variable redundant in the analysis. Total travel budget has the hiighest SCDFC which confirms its importance in the discriminating function. Travel time, also a component of total travel budgets, is also very important in the analysis as it has the second highest SCDFC, although it was not included in the model until the fifth step. Day of the week, the second variable to be included in the model, has a lower SCDFC, but one that is comparable to the value achieved in the during survey. It must be remembered that the step of entry into the model is not necessarily directly related to the variable's SCDFC, since the model accepts variables into the model in order to make the optimal correct classification and it is often the combination of variables included that achieve greater results rather than a variable's individual influence on the discriminant function.

Table 12.11 Variables Discriminating Between Pure Shoppers and Other City Centre Users After Pedestrianisation

Variables	SCDFC
1. Parking Duration	removed from analysis at step 8
2. Day of Week	0.40594
3. Sex	-0.21842
4. Attitudes	-0.12164
5. Travel Time	0.61615
6. Domicile	-0.15978
7. Total Travel Budget	1.11962
8. Parking Duration	removed from analysis
9. No. of Shops Visited	0.20421
10. Occupation	0.08769
11. Shopping Intensity	-0.13696
12. Trouble Parking	0.06625

Analysis conducted without total travel budgets and shopping intensity achieved slightly different results, and a lower classification rate of 76%. Fewer variables were included in the model, although parking duration, day of the week, and sex were still the first three to be entered.

12.3 Attitudes Towards Pedestrianisation

Chapter Nine illustrated that attitudes towards the pedestrianiation scheme changed significantly over the three survey time period, and also showed that attitudes were related to a number of other variables, such as age, sex, parking experiences and shopping behaviour. In order to explore the data to find out which variables were most strongly influencing attitudes, it was decided to apply discriminant analysis to the data. The analysis aimed to find out what variables influenced whether a respondent said that they liked or disliked the scheme. Those who said 'dont know' were excluded from the analysis.

For exploring the before data, the following variables were included in the initial analysis; day of week, car park, domicile, parking duration, type of shopper, age and sex. Only three of these were actually included in the model, day of week, domicile and sex, in that order. Although day of week had a reasonably high standardised canonical discriminant function coefficient (0.87003), the resulting classification rates were very poor (53%), and showed that the model was only achieving a slightly better than random classification.

Analysis on the during and after surveys used the same variables plus queueing time, whether the time limits of car parks were long enough, whether they would have preferred to park elsewhere and whether they had trouble parking. The classification results for the during and after surveys were better than those for the first survey, with 65% and 70% of cases classified correctly. Similar results were found with the variable first to enter the analysis for both surveys being whether they would prefer to park elsewhere (Tables 12.12 and 12.13). In the During survey, whether the time limits were long enough and whether they had trouble parking were the next variables to be entered. However, in the after survey, although trouble parking was entered at the second stage, long enough time limits was only entered at the sixth step with a low SCDFC. Although the standardised canonical discriminant function coefficients are not very high these results do indicate that trouble at the parking stage of a trip to the city centre can strongly influence an individuals' attitude towards pedestrianisation. However, it is interesting that queuing times themselves do not feature very highly in the discriminating function. In the During survey it was entered last with a very small SCDFC, and it was not entered into the model at all in the After survey. It would seem that it is peoples' perception of difficulties at the parking stage rather than any real difficulties that influence their attitudes towards pedestrianisation.

Table 12.12 **Variables Discriminating Between Respondents Liking and Disliking the Scheme During Pedestrianisation**

Variable	SCDFC
1. Prefer to Park Elsewhere	0.48268
2. Long Enough Time	-0.43348
3. Trouble Parking	0.28205
4. Travel Time	0.42600
5. Age	-0.24317
6. Domicile	-0.24914
7. Queuing Time	-0.22917

Table 12.13 Variables Discriminating Between Respondents Liking and Disliking the Scheme After Pedestrianisation.

Variables	SCDFC
1. Prefer to Park Elsewhere	0.72600
2. Trouble Parking	0.45370
3. Age	-0.30151
4. Sex	-0.26556
5. Travel Time	-0.13385
6. Long Enough Time Limits	-0.20510
7. Shopper Type	0.11748
8. Domicile	0.12501

12.4 Summary

This chapter has revealed some interesting results although they tend only to confirm what was already known. The analysis of the shopping behaviour has shown that pure shoppers appear to have the most distictive characteristics and are easier to categorise than the recreational and non-priority shoppers. The strongest discriminant function is that between pure shoppers and other city centre users who have distinctively different characteristics. This confirms what was already discovered in the preliminary analysis, that pure shoppers have shorter parking durations and that the others have long ones. Although other variables were also entered into the model, it is clear from their low SCDFCs that their input into the discriminant function was very small, and that they didn't significantly contribute to the classification rates. The most important variable distinguishing between recreational shoppers and other city centre users is not parking duration, but the number of shops visited. This is probably because the differences in parking duration between these shopper types are not that pronounced since both groups spend quite lengthy periods of time in the city centre, although they are there for different purposes.

The analysis of attitudes also proved interesting, although again the results tend to confirm those discovered in the early analysis. The before survey, which only resulted in a classification rate of 53%, showed that there were no strong relationships between attitudes and the other variables in the model. This is probably because respondents had formed their views on a future proposal and had not experienced either the benefits or the disadvantages that came with pedestrianisation. Once the scheme had been introduced, respondents formed their views from their actual experiences and this resulted in improved classification rates when discriminant analysis was used. The variables that influenced respondents' attitudes towards pedestrianisation were almost all concerned with parking problems and shortcomings, confirming that trouble at the parking stage of a trip to the city centre is very likely to negatively influence respondents' opinions of the scheme.

CHAPTER THIRTEEN

CONCLUSIONS

13.1 Results

This research project represents the first extensive survey which incorporates the study of both behavioural and attitudinal changes during the three year development of pedestrianisation in Plymouth. On the basis of the preceding results, statistics suggest that pedestrianisation has encouraged people to continue visiting the city centre and to stay there for longer periods of time. The results also indicate that although people are staying for longer periods, the city centre does not need a vast increase in the amount of parking facilities. It would appear that the city centre users have re-educated themselves and have adapted their parking and shopping behaviour in light of the changes after initially disliking the instability caused during the introduction of pedestrianisation.

The redesigned city centre has changed from a purely retail and commercial centre to one that now offers recreational and social opportunities and this seems to have met with the approval of the vast majority of local residents. This suggests that planners should not be alarmed by sudden negative changes in opinion during pedestrianisation and in the early stages of a new scheme, as occured in Plymouth, because people appear to find it easy to hold negative views without allowing them to dramatically change their behaviour. Planners should, however, listen and consult with the public throughout the implementation process, making minor changes where appropriate, but not altering the overall aims of their traffic policies.

The results also suggest that retailers in the city centre should welcome pedestrianisation and make an effort to meet the market demands of the shoppers. Because many of the shoppers are no longer simply using the centre for commercial purposes, but also for recreation and social reasons, the retailers should acknowledge the new market and devise methods of meeting its demands in a way that would be beneficial to both themselves and the public. Plymouth city centre (unlike much of the South West), has not traditionally been perceived as a recreational area. The research findings suggest that shopping plus recreation is a major demand in the late twentieth century, and this should be taken into account not only by retailers but also by car park planners and designers.

13.2 Lessons Learnt

This research has confirmed findings from other studies which underline the need for pedestrianisation schemes to form a part of an overall package in the redevelopment of city centres. Particularly important is the problem of ensuring adequate parking facilities. Even though this work has shown that people can adjust to changing levels of provision, reduction in provision can cause much ill feeling, even if as in Plymouth, this was in reality, unjustified. Replacement parking facilities therefore should idealy be provided in advance of enforcing the new traffic regulations.

There is also a need for greater public consultation and publicity throughout all stages of the scheme's development, without which misunderstandings based on uncertainties and lack of reassurance will arise. Retailers and shop owners within and around the affected area should also play a part in the consultation procedure. Planners should discuss the possible impacts of the scheme with them and where feasible, should be prepared to offer palatable suggestions.

13.3 Application Elsewhere

This thesis has applied this particular model to a city that was rebuilt primarily with the motorist in mind, following devastation during the war years. The particular problems facing the planners in Plymouth were therefore different to those experienced by others in cities with ancient and medieval street patterns e.g. York, Norwich. Although accessibility will almost always be a problem when or where ever pedestrian zones are introduced, the Plymouth planners faced additional criticisms since many of the local residents and indeed some councillors, felt that pedestrianisatoion was not necessary in a modern city centre.

Although there are obviously idiosyncratic differences between Plymouth and other cities, the model constructed in this thesis provides a template that can be extended and refined to suit the needs of other city centre planners considering pedestrianisation. It may have particular relevance to the more modern city and town centres of less historical interest which have yet to be pedestrianised. Earlier studies have, perhaps understandably, placed too much emphasis on the pedestrianisation of ancient, narrow streets where the 'ghost town' element was unlikely to emerge. The model can also be used by planners not just on the macro scale but also on the mesoscale in towns throughout the U.K. and, indeed, the world.

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APPENDIX 1

The Guardian
October 20th 1977

...he raping of Plymouth

...years Plymouth ... a model of ...lern city ...ning. Bustling ... lively, it drew ...tors, shoppers and ...ists from all over ... West Country. ... no more. The ...ers have gone and ...assive system of ...estrianisation has ...out wiped out the ... from the town ...re. Martin ...ley reports on the ...ruction of a city.

... its old naval economy, ...ity plan of Plymouth was ...d by war. A series of ...tating air raids in 1941 ...oyed its narrow 19th cen... streets and through the ...tent efforts of the then ... Mayor Lord Astor, it was ...t to a radical new plan ...lved by the celebrated Sir ...atrick Abercrombie and exe...uted by the City Engineer, ...ohn Paton Watson.

After the war the two men ...ecast the centre with a dual ...arriageway ring road enclos...ng a series of wide shopping ...oulevards running from East ... West.

"Goodbye to the narrow and ...aze-like streets; broad ways ...nd modern buildings will ...place them," wrote Astor en...usiastically. "Out of the di...sters of war will be snatched ... victory for the city of the ...ture," agreed the American ...mbassador, John G. Winant. ...nfortunately the future ...rned out to be shorter than ...ther of them could ever have ...agined.

For a generation after ...bercrombie's death in 1957 the ...ew Plymouth, with its broad ...oulevards and quiet, urbane ...chitecture served a growing ...pulation with a prescient ...mbination of broad pave...ents and plentiful on-street ...rking. Although steadfast ...unicipal flower planting along ...mada Way always suggested ...t the city fathers could ...ver come to terms with being ...real city instead of a provin...al town, so well did the plan ...rk that whether you wanted ... buy clothes, open a semi-conductor factory, sell a car, or go to the theatre, the Plymouth catchment area drew you in from a system of radial routes that reached from Truro in the west, north to the Bristol Channel and east to the county town of Exeter, barely half the size of Plymouth.

The Abercrombie plan was one of the very few indisputable successes of modern town planning. Car ownership boomed between 1947 and 1987 but there was no need for any park-and-ride nonsense in Plymouth. Traffic jams were as infrequent, in the words of a resident, "as an eclipse of the sun".

But that was before February 2, 1987. On that day 400 of the 422 parking meters in the city centre were suspended and cars were banned from all but one of the major streets. At the same time 300 more off-street parking spaces were removed when work started on a new multi-storey car park. In proportion to the size of a city of 250,000 people, the scale and suddenness of the event can be compared to the overnight banning of all cars from the whole of central London.

"Plymouth has been destroyed in the name of pedestrianisation," says shopkeeper Wilfred Pollard, leader of the City Centre Business Association, the breakaway group of 140 traders formed to fight the scheme. "There may be old towns that have to be pedestrianised because of the narrow streets but Plymouth isn't one of them.

"It's the ban-the-car movement. They have torn up the beautiful Abercrombie plan. You used to get 2,000 cars a day using those meters, parking right outside the shops. People used to drive from Cornwall because you could always park in Plymouth. Now the traffic system is so contorted that shoppers have to drive half a mile to get into a multi-storey car park.

"The Abercrombie plan made special provision for all sizes of business, from big multiples to tiny shops, and there was on-street parking for all of them. Now they are just going for the big multiples. Parking is being privatised".

In the weeks after February 2 the CCBA hired lawyers to demand a judicial review of the pedestrianisation plan, but without success. In the end they appealed to the local government Ombudsman, who has yet to make his report. Nine months after P-Day Mr Pollard, who sells windows and has traded in Plymouth for 17 years, can point expressively to the Chernobyl-like desolation of Cornwall Street outside his shop and maintain that he is being forced out of business. The street is lined with "closing down" notices. On his desk is a pile of replies from his own survey showing that 89 of the 110 Cornwall Street businesses oppose the scheme. In desperate biro they shriek "this is lunacy" and "Bring back all the meters now." Pollard says that pressure from eight major stores out of the 500 shops in Plymouth brought about pedestrianisation -- Marks and Spencers, Debenhams, Dingles, Boots, Tesco, Co-op, BHS and Lawsons — most of whom have plans for their own captive parking schemes. Virtually all the other traders in the city opposed it but were never consulted about anything except a "temporary experiment."

On the seventh floor of City Hall, City Engineer Colin Nye, the man responsible for pedestrianisation is unmoved by complaints about the scheme. "I suppose you could say that I was responsible for the visionary aspects of the project", he says modestly. "I could have written the script for the protesters months before we started. It will all calm down when the work is finished in the spring of 1988. I've had a lot of experience pedestrianising. I did Leeds and Wakefield before I came here".

Like the city planning officer Christopher Shepley, whose illustrated report, Tomorrow's Plymouth is the bible of pedestrianisers, Nye is a recent arrival in Plymouth. "When I came for my interview I walked up onto the Hoe and said to myself 'I really want this job'. Plymouth was the cleanest city I had ever seen".

Nye is an impressive executive, with facts and figures flowing smoothly out of his head where Pollard stumbles and flails his arms in desperation. Nye makes no secret of the pressure the major retailers applied in order to bring about the annihilation of the Abercrombie plan. He says they not only refused to expand their operations in Plymouth but were actively pursuing competitive sites elsewhere.

"In this business there is no such thing as standing still: you are either ahead or you are falling behind. Plymouth has a name for aggressive development and marketing; good communications, clean environment, skilled workforce and low wage rates. We are very good at meeting programmes set down by outside investors. We were very late pedestrianising, one of the last cities in the country."

And what of the pedestrianisation scheme itself? Surprisingly it is the brainchild of a 24-year-old landscape architecture graduate, named Alexa McGuffie who grew up in one of the most beautiful and isolated places in Devon, the idyllic coastal valley of Lannacombe.

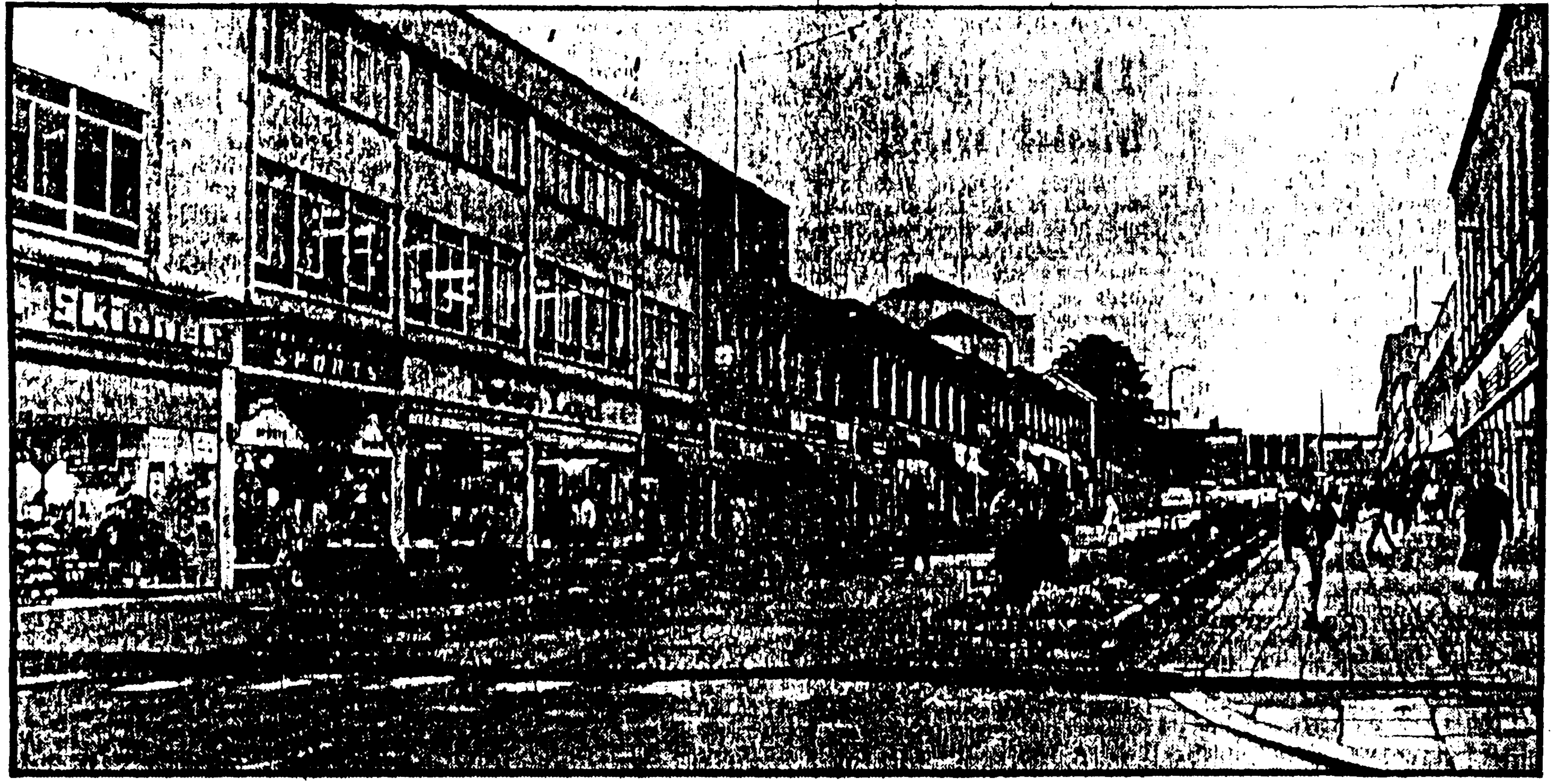
Alexa, who was hired by the city in 1985 to design the £1.2 million pedestrianisation project does not believe she is "Vandalising the Abercrombie plan", as Pollard puts it, but neither will she cite an urban precedent for her arcadian project. She says she draws her inspiration from "consciously and subconsciously studying nature" and has no sympathy with so called urban values.

She sees pedestrianisation as a chance to green a bland and anonymous cityscape with elaborate displays of flowers, shrubs, trees and water features.

But what about the lost hustle and bustle of the city itself, and the despairing traders of the CCBA? "You have to set their problems against the overall improvement in the environment for shoppers, visitors and workers," she insists. "Some of the traders have always complained. I think they are using the scheme as a scapegoat."

With Plymouth in its present state it is difficult to share Miss McGuffie's optimism. Where cars and pedestrians once jostled in the only true city centre in the south west there are now vast open spaces strewn with piles of building materials and contractors' plant. Thin streams of pedestrians straggle out from the broad pavements into what was once the street.

With grisly inappropriateness Christmas decorations are already going up over the roar of pneumatic drills where holes are being dug in the carriageways to plant flowers. Quite apart from its remarkable urban virtues it has turned out that the Abercrombie plan was an engine for keeping small businesses in business. Without it they may not live long



PLYMOUTH city centre — as empty as a western town before a gunfight

Plymouth Polytechnic

Director R F M Robbins OBE BSc PhD CChem FRSC

Drake Circus, Plymouth, Devon, PL4 8AA United Kingdom
Phone (0752) 221312. Telex 45423 PPLRC G

Institute of Marine Studies
Department of Shipping and Transport
Head: Professor D H Moreby, Extra Master, PhD, FNI
Phone: (0752) 264667

Extension 5476
Reply to:

Our ref:

Your ref:

Date: October/November 1988

Dear Sir or Madam,

As a car user in the Plymouth area may I ask for your help in a survey I am undertaking?

As you are probably aware, Plymouth City Centre was pedestrianised nearly 2 years ago and we are anxious to establish how this has affected car parking facilities and peoples' shopping and travel behaviour. In order to be able to put the information to the best possible use I am keen to obtain a reply from every person who receives this questionnaire. I hope that you will be able to spare a few minutes to complete the form.

I would be grateful if you could answer all relevant questions and post back the completed questionnaire in the envelope provided. NO STAMP IS REQUIRED.

Thank you for your co-operation. If you require further information please telephone me or write to me at the above address.

Yours faithfully,

J Meaton

Julia Meaton
Research Assistant

CAR PARKING/PEDESTRIANISATION SURVEY 1988

FOR OFFICE USE ONLY

1. What types of places have you visited since your car has been parked here? (please tick)

Shops 1	Building Socs/ Banks 2	Council/Govt. Offices 3
Restaurants/ Cafes/Pubs 4	Work 5	Other 6

1

2

6 11

13

FOR OFFICE USE ONLY

2. Have you visited any of the following places? (Please tick)

Civic Centre		British Home Stores (BHS)	
Habitat		Woolworths	
Marks & Spencers		Debenhams	
Tesco		Covered Market	
Main Co-op. Store		Sainsburys	
Littlewoods		W.H.Smith	
Dingles		Boots	
C & A		Argos	

20 27 28 35

3. What other stores/places have you visited since your car has been parked here?

1. .... 2. ....

3. .... 4. ....

5. .... 6. ....

36 41 42

4. Which part of Plymouth, or what other town or village do you live in?

....

45 50

5. How long did it take you to travel from your home to the city centre?

....

51 53

6. Once in the city centre, how long did it take you to find a parking space?

....

54 56

7. Did you have any trouble in finding a place to park? (please tick)

YES	NO
1	2

57

FOR OFFICE USE ONLY

8. How long have you parked here today?.......... 53 60

9. Was this long enough? (please tick) 61

YES 1		NO 2	

10. Would you have preferred to park somewhere else? 62

YES 1		NO 2		DON'T KNOW 3	

If YES, go to Question 11
If NO, go to Question 14
If DON'T KNOW, go to Question 15.

11. Leaving out on-street parking meters, where would you have preferred to park? 63

....

12. Can you give one main reason why you would have preferred to park there? (please tick) 64

Easy to find parking space 1	Close to where I want to go 2	Cheaper than other places 3	Other 4

Describe 'other' reason 65
....

13. Why didn't you park there today? 66

....

GO TO QUESTION 15

14. Can you give one main reason why you prefer to park here? (please tick) 67

Easy to find parking space 1	Close to where I want to go 2	Cheaper than other places 3	Other 4

Describe 'other' reason 68
....

PTO

FOR OFFICE USE ONLY

15. Do you think pedestrianisation has improved Plymouth's city centre? (please tick)

YES		NO		DON'T KNOW	
1		2		3	

69

If YES, in what way? ....

....

70 71

If NO, why not? ....

....

73

If DON'T KNOW, why? ....

....

75

16. What is your occupation? ....

77

17. What age group do you belong to? (please tick)

Under 25		25-34		35-44		45-54	
1		2		3		4	
55-64		65 and over					
5		6					

78

18. Sex (please tick)

MALE 1	
FEMALE 2	

79

19. Please add any further comments you might like to make about car parking and pedestrianisation.

....

....

....

....

THANK YOU VERY MUCH FOR YOUR HELP.

Appendix 3.1
Domicile by Surveys

Count Exp Values Row % Col %	Survey 1	Survey 2	Survey 3	Row Total
Inner Plymouth	13 8.7 44.8 1.2	8 9.2 27.6 0.7	8 11.2 27.6 6	29 0.8
Outer Plymouth	376 360.6 31.2 34.8	345 380.3 28.7 30.3	483 463.1 40.1 34.8	1204 33.4
Other Devon and Cornwall	652 685.3 28.5 60.4	757 722.7 33.1 66.5	879 380.0 38.4 63.4	2288 63.4
Distant	39 25.5 45.9 3.6	29 26.8 34.1 2.5	17 32.7 20.0 1.2	85 2.4
Column Total	1080 30.0	1139 31.6	1387 38.5	3606 100.0

CHI SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
26.12518	6	0.0002	8.686	NONE

Missing obs = 0

Appendix 3.2

Reason for Choosing Parking Place by Survey

COUNT EXP VAL ROW % COL %	Survey 1	Survey 2	Survey 3	Row Total
Easy to find a place	183 178.6 19.3 18.9	203 162.3 37.9 22.7	229 282.1 42.8 20.5	535 18.1
Close to final destination	803 702.5 36.5 85.3	601 668.1 27.3 67.2	799 832.4 36.3 71.7	2203 74.7
Cheaper	12 39.9 9.8 1.3	53 37.9 42.4 5.9	60 47.2 48.0 5.4	125 4.2
Other	23 28.1 26.1 2.4	38 26.7 43.2 4.2	27 33.2 30.7 2.4	88 3.0
Column Total	941 31.9	895 30.3	1115 37.8	2951 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
98.86335	5	0.0000	26.689	NONE

Missing obs = 0

Appendix 3.3 - Reasons for Choosing a Car Park by Surveys

Count Exp Value Row % Col %	Before Survey	During Survey	After Survey	Row Total
Easy to find a place	20 9.8 30.0% 16.0% 3.5%	7 15.3 17.5% 3.6% 1.4%	13 14.9 32.5% 6.2% 2.5%	40 7.8%
Close to final destination	89 87.8 24.8% 71.2% 17.4%	144 137.7 40.1% 73.5% 28.2%	126 133.5 35.1% 66.3% 24.7%	355 70.3%
Cheaper	8 20.8 9.4% 6.4% 1.6%	36 32.6 42.4% 18.4% 7.0%	41 31.6 48.2% 21.6% 8.0%	85 16.6%
Other	8 6.6 29.6% 6.4% 1.6%	9 10.4 33.3% 4.6% 1.8%	10 10.0 37.0% 5.3% 2.0%	27 5.3%
Column Total	125 24.5%	196 38.4%	190 37.2%	511 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
27.65068	6	0.0001	6.605	None

Number of Missing Observations = 0

Appendix 3.4

Age by Survey

Count Exp value Row % Col %	Survey 1	Survey 2	Survey 3	Row Total
under 25	118 103.9 32.0 10.1	133 102.4 38.7 11.7	101 131.7 29.4 7.3	344 9.5
25 - 34	238 261.9 27.5 21.8	292 273.2 33.7 25.6	337 331.9 38.9 24.3	867 24.0
35 - 44	294 303.3 29.3 26.9	340 318.3 33.9 29.9	370 384.4 36.9 26.7	1004 27.8
45 - 54	189 183.1 31.2 17.3	178 190.9 29.4 15.6	239 232.0 39.4 17.3	606 16.8
55 - 64	168 151.3 33.5 15.4	126 157.9 25.1 11.1	207 191 41.3 15.0	501 13.9
65 and over	93 88.5 31.7 8.5	70 92.3 23.9 6.1	130 112.3 44.4 9.4	293 8.1
Column Total	1092 30.2	1139 31.5	1384 38.3	3615

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
38.45180	10	0.0000	88.508	NONE

Missing Observations = 0

Appendix 3.5
Gender by Survey

Count Exp val Row % Col %	Survey 1	Survey 2	Survey 3	Row Total
Male	593 532.0 33.6 54.3	509 555.8 37.5 47.7	661 675.2 37.5 47.7	1763 48.7
Female	499 560.0 26.9 45.7	632 585.2 34.1 55.4	725 710.8 39.1 52.3	1856 51.3
Column Total	1092 30.2	1141 31.5	1386 38.3	3619 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
21.93085	2	0.0000	531.969	NONE

Missing Observations = 0

Appendix 3.6

Attitudes Towards Pedestrianisation by Survey

Count Exp Val Row % Col %	Survey 1	Survey 2	Survey 3	Row Total
Yes	728 696.0 31.4 67.2	514 732.6 22.2 45.0	1876 889.3 46.4 77.7	2318 64.2
No	305 278.7 32.9 28.1	422 293.3 45.5 37.0	201 356.0 21.7 14.5	928 25.7
Don't Know	51 109.3 14.0 4.7	205 115.0 56.3 18.0	108 139.7 29.7 7.8	364 10.1
Column Total	1084 30.0	1141 31.6	1385 38.4	3610 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
340.96820	4	0.0000	109.301	NONE

NUMBER OF MISSING OBSERVATIONS = 0

APPENDIX 3.7

REASONS FOR LIKING THE PEDESTRIANISATION SCHEME BY SURVEY

COUNT EXP VAL ROW % COL %	SURVEY 2	SURVEY 3	ROW TOTAL
SAFER	172 171.0 29.1 27.1	419 420.0 70.9 26.9	391 26.9
EASIER TO MOVE AROUND	298 223.3 37.8 46.9	491 560.7 62.2 31.5	789 33.9
ENVIRONMENTAL REASONS	151 225.9 19.3 23.8	630 555.1 80.7 40.4	781 35.6
LESS CONGESTED	14 9.8 41.2 2.2	20 24.2 58.8 1.3	34 1.5
COLUMN TOTAL	635 28.9	1560 71.1	2195 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
67.44974	3	0.0000	9.836	NONE

MISSING OBS = 0

APPENDIX 3.8

REASONS FOR NOT LIKING THE SCHEME BY SURVEY

COUNT EXP VAL ROW % COL %	SURVEY 2	SURVEY 3	ROW TOTAL
DIFFICULT TO MOVE AROUND	76 86.6 60.3 13.7	50 39.4 39.7 19.8	126 15.6
PARKING PROBLEMS	178 178.7 68.5 32.0	82 81.3 31.5 32.4	70 8.7
DONT NEED IT IN PLYMOUTH	49 49.5 68.1 5.8	23 22.5 31.9 9.1	72 8.9
GHOST TOWN ATMOSPHERE	101 74.9 92.7 16.2	8 34.1 7.3 3.2	109 13.5
ENVIRONMENTAL REASONS	40 45.4 60.6 7.2	26 20.6 39.4 10.3	66 8.2
POOR TRAFFIC PLANS	73 72.9 68.9 13.1	33 33.1 31.1 13.0	106 13.1
OTHER	39 48.1 55.7 7.8	31 21.9 44.3 12.3 3.8	70 8.7
COLUMN TOTAL	556 68.7	253 31.3	809 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
40.76028	6	0.0000	20.640	NONE

MISSING OBS = 0

Appendix 3.9 - Travel Time by Parking Duration

Count Exp Value Row % Col %	30 mins & Under	31-60 mins	61-121 mins	122-180 mins	181-240 mins	Over 4 hours	Row Total
5 mins & Under	4 3.0 4.5% 10.3%	27 10.5 30.3% 20.0%	36 34.7 40.4% 8.1%	11 20.2 12.4% 4.2%	6 9.4 6.7% 5.0%	5 11.1 5.6% 3.5%	89 7.8%
6-10 mins	8 7.8 3.5% 20.5%	31 27.0 13.5% 23.0%	116 89.3 50.7% 26.0%	43 52.0 18.2% 16.5%	12 24.2 5.2% 9.9%	19 28.6 8.3% 13.3%	229 20.0%
11-15 mins	10 9.0 3.8% 25.6%	39 31.0 14.2% 28.9%	104 102.5 39.5% 23.3%	62 59.8 23.6% 23.8%	24 27.8 9.1% 19.8%	24 32.9 9.1% 16.8%	263 23.0%
16-30 mins	10 11.2 3.0% 25.6%	20 38.7 6.1% 14.8%	137 127.9 41.8% 30.7%	82 74.5 25.0% 31.5%	36 34.7 11.0% 29.8%	43 41.0 13.1% 30.1%	328 28.7%
31-60 mins	5 6.4 2.7% 12.8%	15 22.1 8.0% 11.1%	47 72.9 25.1% 10.5%	51 42.5 27.3% 19.6%	34 19.8 18.2% 28.1%	35 23.4 18.7% 24.5%	187 16.3%
61-120 mins	2 1.1 6.5% 5.1%	2 3.7 6.5% 1.5%	2 12.1 6.5% .4%	6 7.0 19.4% 2.3%	6 3.3 19.4% 5.0%	13 3.9 41.9% 9.1%	31 2.7%
Over 4 hours	0 .6 .0% .0%	1 2.0 5.9% .7%	4 6.6 23.5% .9%	5 3.9 29.4% 1.9%	3 1.8 17.6% 2.5%	4 2.1 23.5% 2.8%	17 1.5%
Column Total	39 3.4%	135 11.8%	446 39.0%	260 22.7%	121 10.6%	143 12.5%	1144 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
138.84	30	0.0000	0.580	10 OF 42 (23.8%)

Number of Missing Observations = 1

Appendix 3.10 - Travel Time by Parking Duration

Count Exp Value Row % Col %	30 mins & Under	31-60 mins	61-121 mins	122-180 mins	181-240 mins	Over 4 hours	Row Total
5 mins & Under	10 2.4 11.9% 25.0%	11 8.5 13.1% 7.8%	42 36.0 50.0% 7.0%	15 16.3 17.9% 5.5%	2 7.7 2.4% 1.6%	4 13.1 4.8% 1.8%	84 6.0%
6-10 mins	6 8.5 2.0% 15.0%	49 30.1 16.4% 34.8%	153 127.9 51.3% 25.5%	52 57.8 17.4% 19.2%	21 27.3 7.0% 16.4%	17 46.4 5.7% 7.8%	298 21.3%
11-15 mins	14 10.1 4.0% 35.0%	37 35.6 10.5% 26.2%	165 151.0 46.9% 27.5%	77 68.3 21.9% 28.4%	26 32.3 7.4% 20.3%	33 54.7 9.4% 15.2%	352 25.2%
16-30 mins	8 12.6 1.8% 20.0%	34 44.5 7.7% 24.1%	200 189.2 45.4% 33.4%	93 85.6 21.1% 34.3%	38 40.4 8.6% 29.7%	68 68.6 15.4% 31.3%	441 31.6%
31-60 mins	2 5.2 1.1% 5.0%	9 18.4 4.9% 6.4%	36 78.1 19.8% 6.0%	32 35.3 17.6% 11.8%	35 16.7 19.2% 27.3%	68 28.3 37.4% 31.3%	182 13.0%
61-120 mins	0 .9 .0% .0%	9 3.0 .0% .0%	3 12.9 10.0% .5%	1 5.8 3.3% .4%	5 2.8 16.7% 3.9%	21 4.7 70.0% 9.7%	30 2.1%
Over 2 hours	0 .3 .0% .0%	1 .9 11.1% .7%	0 3.9 .0% .0%	1 1.7 11.1% .4%	1 .8 11.1% .8%	6 1.4 66.7% 2.8%	9 .6%
Column Total	40 2.9%	141 10.1%	599 42.9%	271 19.4%	128 9.2%	217 15.5%	1396 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
293.62	30	0.0000	0.258	11 OF 42 (26.2%)

Number of Missing Observations = 0

Appendix 3.11 - Trouble Parking by Queuing Time

Count Exp Value Row % Col %	1 min & Under	2–5 mins	6–10 mins	11–15 mins	16–30 mins	Over 30 mins	Row Total
Yes	7 64.6 4.0% 1.6% -57.6	13 68.3 7.5% 2.9% -53.3	54 28.8 31.2% 36.0% 31.2	35 6.5 20.2% 81.4% 28.5	56 9.6 32.4% 88.9% 46.4	8 1.2 4.6% 100.0% 6.8	173 15.2%
No	419 361.4 43.3% 98.4% 57.6	437 381.7 45.2% 97.1% 55.3	96 127.2 9.9% 64.0% -31.2	8 36.5 .8% 18.6% -28.5	7 53.4 .7% 11.1% 46.4	0 6.8 .0% .0% -6.8	967 84.8%
Column Total	426 37.4%	450 39.5%	160 13.2%	43 3.8%	63 5.5%	8 .7%	1140 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
621.03881	5	0.0000	1.214	1 OF 12 (8.3%)

Appendix 3.12 - Trouble Parking by Queuing Time

Count Exp Value Row % Col %	1 min & Under	2-5 mins	6-10 mins	11-15 mins	16-30 mins	Row Total
Yes	0	31	56	41	38	166
	70.0	63.8	19.1	6.9	6.1	12.0%
	.0%	18.7%	33.7%	24.7%	22.9%	
	.0%	5.8%	35.0%	70.7%	74.5%	
	-70.0	-32.8	36.9	34.1	31.9	
No	585	502	104	17	13	1221
	515.0	469.2	140.9	51.1	44.9	88.0%
	47.9%	41.1%	8.5%	1.4%	1.1%	
	100.0%	94.2%	65.0%	29.3%	25.5%	
	70.0	32.8	-36.9	-34.1	-31.9	
Column Total	585	533	160	58	51	1387
	42.2%	38.4%	11.5%	4.2%	31.7%	100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
558.39804	4	0.0000	6.104	None

Number of Missing Observations = 9

Appendix 3.13 - Car Park by Prefer to Park Elsewhere

Count Exp Value Row % Col %	Yes	No	Don't Know	Row Total
Campbell	24 17.8 23.8% 12.1%	71 81.0 70.3% 7.9%	6 2.2 5.9% 25.0%	101 9.0%
Charles	36 38.0 16.7% 18.2	172 172.4 80.0% 19.1%	7 4.6 3.3% 29.2%	215 19.2%
Derrys	11 10.8 18.0% 5.6%	50 48.9 82.0% 5.6%	0 1.3 .0% .0%	61 5.4%
Mayf West	34 46.5 12.9% 17.2%	223 210.9 84.4% 24.8%	6 5.6 2.3% -5.0%	263 23.5%
Mayf East	18 23.0 13.8% 9.1%	110 104.3 84.6% 12.2%	2 2.8 1.5% 8.3%	130 11.6%
M and S	9 6.9 23.1% 4.5%	30 31.3 76.9% 3.3%	0 .8 .0% .0%	39 3.5%
Woolworths	7 4.9 25.0% 3.5%	21 22.5 75.0% 2.3%	0 .6 .0% .0%	28 2.5%
Lockyer	27 15.4 31.0% 13.6%	60 69.8 69.0% 6.7%	0 1.9 .0% .0%	87 7.8%
Sainsburys	32 34.8 16.2% 16.2%	162 158.0 82.2% 18.0%	3 4.2 1.5% 12.5%	197 17.6%
Column Total	198 17.7%	899 80.2%	24 2.1%	1121 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
34.32064	16	0.0049	0.599	9 OF 27 (33.3%)

Number of Missing Observations = 24

Appendix 3.14 - Car Park by Whether Time Restrictions on Car Parks Were Long Enough

Count Exp Value Row % Col %	Yes	No	Don't Know	Row Total
Campbell	75 86.6 74.3% 7.8%	26 14.3 25.7% 16.4%	0 .1 .0% .0%	101 9.0%
Charles	192 184.4 89.3% 19.9%	23 30.4 10.7% 14.5%	0 .2 .0% .0%	215 19.1%
Derrys	60 52.3 98.4% 6.2%	1 8.6 1.6% .6%	0 .1 .0% .0%	61 5.4%
Mayf West	243 226.5 92.0% 25.2%	20 37.3 7.6% 12.6%	1 .2 .4% 100.0%	264 23.5%
Mayf East	122 112.4 93.1% 12.6%	9 18.5 6.9% 5.7%	0 .1 .0% .0%	131 11.6%
M and S	23 33.5 59.0% 2.4%	16 5.5 41.0% 10.1%	0 .0 .0% .0%	39 3.5%
Woolworths	15 24.0 53.6% 1.6%	13 4.0 46.4% 8.2%	0 .0 .0% .0%	28 2.5%
Lockyer	81 74.6 93.1% 8.4%	6 12.3 6.9% 3.8%	0 .1 .0% .0%	87 7.7%
Sainsburys	154 170.7 77.4% 16.0%	45 28.1 22.6% 28.3%	0 .2 .0% .0%	199 17.7%
Column Total	965 85.8%	159 14.1%	1 .1%	1125 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
102.17930	16	0.0000	0.025	10 OF 27 (37.0%)

Number of Missing Observations = 20

Appendix 3.15 - Car Park by Whether Time Restrictions on Car Parks Were Long Enough

Count Exp Value Row % Col %	Yes	No	Don't Know	Row Total
Campbell	81 93.1 76.4% 6.8%	23 12.6 23.6% 15.2%	0 .1 .0% .0%	106 7.8%
Charles	207 197.7 92.0% 17.3%	18 27.2 8.0% 10.9%	0 .2 .0% .0%	225 16.5%
Derrys	37 35.1 92.5% 3.1%	2 4.8 5.0% 1.2%	1 .0 2.5% 100.0%	40 2.9%
Mayf West	268 253.3 91.2% 22.3%	26 35.5 8.8% 15.8%	0 .2 .0% .0%	294 21.5%
Mayf East	137 143.2 84.0% 11.4%	26 19.7 16.0% 15.8%	0 .1 .0% .0%	163 11.9%
M and S	27 36.9 64.3% 2.3%	15 5.1 35.7% 9.1%	0 .0 .0% .0%	42 3.1%
Woolworths	21 23.7 77.8% 1.8%	6 3.3 22.2% 3.6%	0 .0 .0% .0%	27 2.0%
Lockyer	73 70.3 91.3% 6.1%	7 9.7 8.8% 4.2%	0 .1 .0% .0%	80 5.9%
Sainsburys	203 205.6 86.8% 16.9%	31 28.3 13.2% 18.8%	0 .2 .0% .0%	234 17.1%
	146 136.2 94.2% 12.2%	9 18.7 5.8% 5.5%	0 .1 .0% .0%	155 11.3%
Column Total	1200 87.8%	165 12.1%	1 .1%	1366 100.0%

Appendix 3.15 (Contd)

Chi-Square	DF	Significance	Min EF	Cells with EF 5
88.43364	18	0.0000	0.020	12 OF 30 (40.0%)

Number of Missing Observations = 30

APPENDIX 3.16

Places visited by day of week			
count exp val row % col %	Friday 25.1.85	Saturday 2.2.85	Row Total
pure	402 437.9 45.9 73.5	473 437.1 54.1 86.6	875 80.1
recreational	34 27.0 63.0 6.2	20 27.0 37.0 3.7	54 4.9
other	111 82.1 67.7 20.3	53 81.9 32.3 9.7	164 15.0
column total	547 50.0%	546 50.0%	1093 100.0%

CHI-SQ UARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS E.F.> 5
29.90209	2	0.0000	26.975	NONE

Missing obs = 0

Appendix 3.17

Shopper Type by Day of Week			
count exp val row % col %	Tuesday	Saturday	Row Total
Other	178 130.2 66.2 31.4	90 135.8 33.8 15.4	266 23.3
Recreational	156 176.2 43.3 27.9	204 183.8 56.7 34.9	360 31.5
Pure	228 253.6 44.0 40.7	290 264.4 56.0 49.7	518 45.3
Column Total	560 49.0%	584 51.0%	1144 100.0%

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS E.F.<5
41.13997	2	0.0000	130.210	NONE

Missing Obs = 1

Appendix 3.18
Shopper Type By Day of the Week

Count Exp value Row % Col %	Friday	Saturday	Row Total
Other	209 144.0 65.5 33.2	110 175.0 34.5 14.4	319 22.9
Recreational	145 182.3 35.9 23.0	259 221.7 64.1 33.8	404 29.9
Pure	276 303.7 41.0 43.8	397 369.3 59.0 51.8	673 48.2
Column Total	630 45.1%	766 54.9	1396 100.0%

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS With E.F.< 5
72.08212	2	0.0000	143.961	NONE

Missing Obs = 0

Appendix 3.19 - Shopper Type by Reason for Choosing a Car Park

Count Exp Value Row % Col %	Easy Park	Close To	Cheaper	Other	Row Total
Other	25 44.0 14.9% 14.3%	142 130.0 75.2% 23.6%	9 11.5 4.6% 17.0%	14 8.1 7.2% 36.8%	194 21.7%
Recreational	80 65.8 27.6% 39.4%	191 194.7 65.9% 31.8%	8 17.2 2.8% 15.1%	11 12.3 3.8% 28.9%	290 32.4%
Pure	94 93.2 22.9% 46.3%	268 276.0 65.2% 44.6%	36 24.3 8.8% 67.9%	13 17.5 3.2% 34.2%	411 45.9%
Column Total	203 22.7%	601 67.2%	53 5.9%	38 4.2%	895 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
25.88934	6	0.0002	8.237	None

Number of Missing Observations= 250

Appendix 3.20 - Shopper Type by Whether Time Restrictions Were Long Enough

Count Exp Value Row % Col %	Yes	No	Row Total
Other	233 226.7 88.3% 24.1%	31 37.3 11.7% 19.5%	264 23.5%
Recreational	317 303.9 89.5% 32.8%	37 50.1 10.5% 23.3%	354 31.5%
Pure	415 434.4 82.0% 43.0%	91 71.6 18.0% 57.2%	506 45.0%
Column Total	965 85.9%	159 14.1%	1124 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
11.37112	2	0.0034	37.345	None

Number of Missing Observations = 21

Appendix 3.21 - Shopper Type by Whether Time Restrictions Were Long Enough

Count Exp Value Row % Col %	Yes	No	Row Total
Other	289 276.1 92.0% 24.1%	25 37.9 8.0% 15.2%	314 23.0%
Recreational	343 349.9 86.2% 28.6%	55 48.1 13.8% 33.3%	398 29.1%
Pure	569 575.0 87.0% 47.4%	85 79.0 13.0% 51.5%	654 47.9%
Column Total	1201 87.9%	165 12.1%	1366 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
6.66566	2	0.0357	37.928	None

Number of Missing Observations = 30

Appendix 3.22 - Shopper Type by Trouble Parking

Count Exp Value Row % Col %	Yes	No	Row Total
Other	44 40.1 16.7% 25.4%	220 223.9 83.3% 22.8%	264 23.2%
Recreational	40 54.4 11.1% 23.1%	319 304.5 88.9% 33.0%	359 31.5%
Pure	89 78.5 17.2% 51.4%	428 438.5 82.8% 44.3%	517 45.4%
Column Total	173 15.2%	967 84.8%	1140 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
6.66329	2	0.0357	40.063	None

Number of Missing Observations = 5

Appendix 3.23 - Shopper Type by Prefer to Park Elsewhere

Count Exp Value Row % Col %	Yes	No	Don't Know	Row Total
Other	77 45.2 24.8% 38.9%	230 257.7 74.2% 20.4%	3 7.1 1.0% 9.7%	310 22.8%
Recreational	45 57.8 11.4% 22.7%	336 329.2 84.8% 29.8%	15 9.0 3.8% 48.4%	396 29.2%
Pure	76 95.0 11.7% 38.4%	562 541.1 86.3% 49.8%	13 14.9 2.0% 41.9%	651 48.0%
Column Total	198 14.6%	1128 83.1%	31 2.3%	1357 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
39.36053	4	0.0000	7.082	None

Number of Missing Observations = 39

Appendix 3.24 - Shopper Type by Reason Prefer to Park Elsewhere

Count Exp Value Row % Col %	Easy Park	Close To	Cheaper	Other	Row Total
Other	0 5.1 .0% .0%	53 49.1 71.6% 42.1%	18 16.0 24.3% 43.9%	3 3.9 4.1% 30.0%	74 38.9%
Recreational	3 2.9 7.0% 23.1%	27 28.5 62.8% 21.4%	11 9.3 25.6% 26.8%	2 2.3 4.7% 20.0%	43 22.6%
Pure	10 5.0 13.7% 76.9%	46 48.4 63.0% 36.5%	12 15.8 16.4% 29.3%	5 3.8 6.8% 50.0%	73 38.4%
Column Total	13 6.8%	126 66.3%	41 21.6%	10 5.3%	190 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
12.65160	6	0.0489	2.263	5 OF 12 (41.7%)

Number of Missing Observations = 1206

Appendix 3.25 - Age By Queuing Time

Count Exp Value Row % Col %	1 min & Under	2-5 mins	6-10 mins	11-15 mins	16-30 mins	Over 30 mins	Row Total
Under 25	34 49.7 25.6% 8.0%	59 52.5 44.4% 13.1%	26 17.4 19.5% 17.4%	10 5.0 7.5% 23.3%	3 7.4 2.3% 4.8%	1 .9 .8% 12.5%	133 11.7%
25-34	86 109.2 29.5% 20.2%	135 115.4 46.2% 30.0%	44 38.2 15.1% 29.5%	9 11.0 3.1% 20.9%	16 16.2 5.5% 25.4%	2 2.1 .7% 25.0%	292 25.6%
35-44	142 127.2 41.8% 33.3%	126 134.3 37.1% 28.0%	34 44.5 10.0% 22.8%	15 12.8 4.4% 34.9%	21 18.8 6.2% 33.3%	2 2.4 .6% 25.0%	340 29.9%
45-54	58 66.6 32.6% 13.6%	77 70.3 43.3% 17.1%	21 23.3 11.8% 14.1%	6 6.7 3.4% 14.0%	15 9.8 8.4% 23.8%	1 1.3 .6% 12.5%	178 15.6%
55-64	70 47.1 55.6% 16.4%	31 49.8 24.6% 6.9%	16 16.5 12.7% 10.7%	1 4.8 .8% 2.3%	7 7.0 5.6% 11.1%	1 .9 .8% 12.5%	126 11.1%
65 + over	36 26.2 51.4% 8.5%	22 27.7 31.4% 4.9%	8 9.2 11.4% 5.4%	2 2.6 2.9% 4.7%	1 3.9 1.4% 1.6%	1 .5 1.4% 12.5%	70 6.1%
Column Total	426 37.4%	450 39.5%	149 13.1%	43 3.8%	63 5.5%	8 .7%	1139 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
66.24970	25	0.0000	0.492	9 OF 36 (25.0%)

Number of Missing Observations = 6

Appendix 3.26 - Age By Queuing Time

Count Exp Value Row % Col %	1 min & Under	2-5 mins	6-10 mins	11-15 mins	16-30 mins	Over 30 mins	Row Total
Under 25	26 42.8 25.7% 4.4%	45 38.5 44.0% 8.5%	21 11.7 20.8% 13.0%	6 4.1 8.9% 10.7%	2 3.5 2.0% 4.2%	1 .4 1.0% 20.0%	101 7.3%
25-34	119 142.7 35.3% 20.3%	139 128.6 41.2% 26.3%	45 39.2 13.4% 28.0%	16 13.6 4.7% 28.6%	17 11.7 5.0% 35.4%	1 1.2 .3% 20.0%	337 24.3%
35-44	139 136.7 37.6% 23.7%	185 141.2 44.6% 31.3%	38 43.0 10.3% 23.6%	20 15.0 5.4% 35.7%	7 12.8 1.9% 14.6%	1 1.3 20.0% 20.0%	370 26.7%
45-54	119 101.2 49.8% 20.3%	81 91.2 33.9% 15.3%	27 27.8 11.3% 16.8%	2 9.7 .8% 3.6%	9 8.3 3.8% 18.8%	1 .9 .4% 20.0%	239 17.3%
55-64	106 87.6 51.2% 18.1%	64 79.0 30.9% 12.1%	17 24.1 8.2% 10.6%	8 8.4 3.9% 14.3%	11 7.2 5.3% 22.9%	1 .7 .5% 20.0%	207 15.0%
65 + over	77 55.0 59.2% 13.1%	34 49.6 26.2% 6.4%	13 15.1 10.0% 8.1%	4 5.3 3.1% 7.1%	2 4.5 1.5% 4.2%	0 .5 .0% .0%	130 9.4%
Column Total	586 42.3%	528 38.2%	161 11.6%	56 4.0%	48 3.5%	5 .4%	1384 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
74.08725	25	0.000	0.365	9 OF 36 (25.0%)

Appendix 3.27 - Age by Parking Duration

Count Exp Value Row % Col %	30 mins & Under	31-60 mins	61-121 mins	122-180 mins	181-240 mins	Over 4 hours	Row Total
Over 25	0 2.6 .0% .0%	13 10.1 12.9% 9.4%	33 43.4 32.7% 3.5%	15 19.8 14.9% 5.5%	13 9.3 12.9% 10.2%	27 15.8 26.7% 12.5%	101 7.3%
25-34	6 8.8 1.8% 16.7%	34 33.6 10.1% 24.6%	138 144.9 40.9% 23.2%	65 66.0 19.3% 24.0%	33 31.2 9.8% 25.8%	61 52.6 18.1% 28.2%	337 24.3%
35-44	9 9.6 2.4% 25.0%	28 36.9 7.6% 20.3%	155 159.1 41.9% 26.1%	90 72.4 24.3% 33.2%	38 34.2 10.3% 29.7%	50 57.7 13.5% 23.1%	370 26.7%
45-54	10 6.2 4.2% 27.8%	22 23.8 9.2% 15.9%	95 102.7 39.7% 16.0%	46 46.8 19.2% 17.0%	21 22.1 8.8% 16.4%	45 37.3 18.8% 20.8%	239 17.3%
55-64	5 5.4 2.4% 13.9%	17 20.6 8.2% 12.3%	105 89.0 50.7% 17.6%	36 40.5 17.4% 13.3%	19 19.1 9.2% 14.8%	25 32.3 12.1% 11.6%	207 15.0%
65 & Over	6 3.4 4.6% 16.7%	24 13 0 18.5% 17.4%	69 55.9 53.1% 11.6%	19 25.5 14.6% 7.0%	4 12.0 3.1% 3.1%	8 20.3 6.2% 3.7%	130 9.4%
Column Total	36 2.6%	138 10.0%	595 43.0%	271 19.6%	128 9.2%	216 15.6%	1384 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
65.57500	25	0.0000	2.627	2 OF 36 (5.6%)

Number of Missing Observations = 12

Appendix 3.28 - Age by Shopper Type

Count Exp Value Row % Col %	Other	Recreational	Pure	Row Total
Under 25	29 30.7 21.8% 11.0%	46 42.0 34.6% 12.8%	58 60.3 43.6% 11.2%	133 11.7%
25-34	52 67.4 17.8% 19.8%	81 92.3 27.7% 22.5%	159 132.3 54.5% 30.8%	292 25.6%
35-44	75 78.5 22.1% 28.5%	97 107.5 28.5% 16.9%	168 154.0 49.4% 32.6%	340 29.9%
45-54	47 41.1 26.4% 17.9%	60 56.3 33.7% 16.7%	71 80.6 39.9% 13.8%	178 15.6%
55-64	42 29.1 33.3% 16.0%	51 39.8 40.5% 14.2%	33 57.1 26.2% 6.4%	126 11.1%
65 and Over	18 16.2 25.7% 6.8%	25 22.1 35.7% 6.9%	27 31.7 38.6% 5.2%	70 6.1%
Column Total	263 23.1%	360 31.6%	516 45.3%	1139 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
35.85165	10	0.0001	16.163	None

Number of Missing Observations = 6

Appendix 3.29
Age by Day of the Week

Count Exp Values Row % Col %	Tuesday	Saturday	Row Total
under 25	46 65.2 34.6 8.2	87 67.8 65.4 15.0	133 11.7
25 - 34	116 143.2 39.7 20.8	176 148.8 60.3 30.3	292 25.7
35 - 44	179 166.2 52.8 32.1	160 172.8 47.2 27.6	339 29.8
45 - 54	89 87.3 50.0 15.9	89 90.7 50.0 15.3	178 15.6
55 - 64	73 61.8 57.9 13.1	53 64.2 42.1 9.1	126 11.1
65 and over	55 34.3 78.6 9.8	15 35.7 21.4 2.6	70 6.2
Column Total	558 49.0	580 51.0	1138 100.0%

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
31.65891	5	0.0000	34.323	NONE

Missing obs = 7

Appendix 3.30

Age by Day of Week

Count Exp Values Row % Col %	Friday	Saturday	Row Total
under 25	29 45.7 28.7 4.6	72 55.3 71.3 9.5	101 7.3
25 - 34	147 152.4 43.6 23.5	190 184.6 56.4 25.1	337 24.3
35 - 44	153 167.4 41.4 24.4	217 202.6 58.6 28.6	370 26.7
45 - 54	103 108.1 43.1 16.5	136 130.9 56.9 17.9	239 17.3
55 - 64	99 93.6 47.8 15.8	108 113.4 52.2 14.2	207 15.0
65 and over	95 58.8 73.1 15.2	35 71.2 26.9 4.6	130 9.4
Column Total	626 45.2	758 54.8	1384 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
55.41847	5	0.0000	45.684	NONE

Missing obs = 12

Appendix 3.31 - Age by Attitudes Towards Pedestrianisation

Count Exp Value Row % Col %	Yes	No	Don't Know	Row Total
Under 25	49 60.0 36.8% 9.6%	49 49.1 36.8% 11.7%	35 24.0 26.3% 17.1%	133 11.7%
25-34	160 131.6 54.8% 31.2%	82 107.8 28.1% 19.5%	50 52.6 17.1% 24.4%	292 25.7%
35-44	150 153.3 44.1% 29.2%	137 125.5 40.3% 32.6%	53 61.2 15.6% 25.9%	340 29.9%
45-54	76 80.2 42.7% 14.8%	77 65.7 43.3% 18.3%	25 32.1 14.0% 12.2%	178 15.6%
55-64	52 56.3 41.6% 10.1%	46 46.1 36.8% 11.0%	27 22.5 21.6% 13.2%	125 11.0%
65 and over	26 31.6 37.1% 5.1%	29 25.8 41.4% 6.9%	15 12.6 21.4% 7.3%	70 6.2%
Column Total	513 45.1%	420 36.9%	205 18.0%	1138 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
28.50532	10	0.0015	12.610	None

Number of Missing Observations = 7

Appendix 3.32 - Gender by Car Park

Count Exp Value Row % Col %	Campbell	Charles	Derry	Guildhall	Mayf West	Mayf East	M & S	W Morn N	Wool- worths	Wool- worths	Row Total
Male	96 79.9 16.2% 65.3%	66 78.8 11.1% 45.5%	66 54.4 11.1% 66.0%	53 47.3 8.9% 60.9%	75 75.6 12.6% 54.0%	78 101.1 13.2% 41.9%	25 37.0 4.2% 36.8%	22 21.7 3.7% 55.0%	35 36.4 5.9% 52.2%	13 13.6 2.2% 52.0%	593 54.4%
Female	51 67.1 10.2% 34.7%	79 66.2 15.9% 54.5%	34 45.6 6.8% 34.0%	34 39.7 5.8% 39.1%	64 63.4 12.9% 46.0%	108 84.9 21.7% 58.1%	43 31.0 8.6% 63.2%	18 18.3 3.6% 45.0%	32 30.6 6.4% 47.8%	12 11.4 2.4% 48.0%	498 45.6%
Column Total	147 13.5%	145 13.3%	100 9.2%	87 8.0%	139 12.7%	186 17.0%	68 6.2%	40 3.7%	67 6.1%	25 2.3%	1091 100.0%

	Lockyer	Row Total
Male	64 47.3 10.8% 73.6%	593 54.4%
Female	23 39.7 4.6% 26.4%	498 45.6%
Column Total	87 8.0%	1091 100.0%

Chi-Square	DF	Significance	Min EF	Cells with EF 5
51.82124	10	0.0000	11.412	None

Number of Missing Observations = 2

Appendix 3.33

Attitudes Towards Pedestrianisation by Queuing Time

Count exp val row % col %	1 minute and under	2 to 5 minutes	6 to 10 minutes	11 to 30 minutes	Over 30 minutes	Row Total
Yes	220 182.4 48.9 17.6	222 203.2 43.2 49.2	51 47.1 1.9 40.9	7 19.4 1.4 16.3	14 32.0 2.7 19.7	514 45.0
No	123 157.9 30.3 30.0	156 166.6 37.0 34.6	63 55.1 14.9 42.3	25 15.9 5.9 58.1	50 26.3 11.8 70.4	422 37.0
Don't Know	89 76.7 43.4 20.8	73 81.0 35.6 16.2	23 26.8 12.2 16.8	11 7.7 5.4 25.6	7 12.8 3.4 9.9	205 18.0
Column Total	427 37.4	451 39.5	149 13.1	43 3.8	71 6.2	1141 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
22.95634	2	0.0000	7.726	NONE

Appendix 3.34

Attitudes Towards Pedestrianisation by Queuing Time

Count Exp val Row % Col %	1 minute and under	2 to 5 minutes	6 to 10 minutes	11 to 30 minutes	over 30 minutes	Row Total
Yes	457 454.5 42.5 78.1	426 411.8 39.6 80.5	123 125 11.4 76.4	36 44.3 3.3 63.2	34 41.2 3.2 64.2	1076 77.7
No	80 84.9 39.8 13.7	65 76.3 32.3 12.3	27 23.4 13.4 16.8	15 8.3 7.5 26.3	14 7.7 7.0 26.4	201 14.5
Don't Know	48 45.6 44.4 8.2	38 41.3 35.2 7.2	11 12.6 10.2 6.8	6 4.4 5.6 10.5	5 4.1 4.6 9.4	108 7.8
Column Total	585 42.2	529 38.2	161 11.6	57 4.1	53 3.8	1385 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
17.99316	8	0.0213	4.133	2 OF 15 (13.3%)

Appendix 3.35

Attitudes Towards Pedestrianisation by Reasons for Choosing Car Parks

Count Exp val Row % Col %	Easy to park	Close to final destination	Cheaper	Other	Row Total
Yes	113 88.5 25.7 55.9	298 298.1 67.3 49.3	22 26.1 5.0 41.5	9 16.2 2.0 24.3	440 49.3
No	41 64.2 14.4 20.3	206 191.1 72.6 35.8	19 18.9 6.7 35.8	18 11.8 6.3 48.6	284 31.8
Don't Know	45 33.2 28.4 23.8	99 113.7 58.6 16.5	12 10.0 7.1 22.6	10 7.0 5.9 27.0	169 18.9
Column Total	202 22.6	601 67.3	53 5.9	37 4.1	893 100.0

CHI-SQUARE	D.F	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
26.36193	6	0.0002	7.002	NONE

MISSING OBS = 252

Appendix 3.36

Attitudes Towards Pedestrianisation by Trouble Parking

Count Exp val Row% Col %	Yes	No	Row Total
Yes	43 78.0 8.4 24.9	469 434.0 91.6 48.7	512 45.1
No	102 64.8 24.3 58.0	318 356.0 75.7 33.0	420 37.0
Don't Know	25 31.1 13.7 16.2	176 172.9 86.3 18.3	204 18.0
Column Total	173 15.2	963 184.8	1136 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
55.54674	2	0.0000	31.067	NONE

Appendix 3.37

Attitudes Towards Pedestrianisation by Trouble Parking

Count Exp val Row % Col %	Yes	No	Row Total
Yes	106 129.0 9.9 63.9	965 942.0 90.1 79.6	1071 77.7
No	45 24.0 22.6 27.1	154 175.0 77.4 12.7	199 14.4
Don't Know	15 13.0 13.9 9.0	93 95.0 86.1 7.7	108 7.8
Column Total	166 12.0	1212 88.0	1378 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
25.98558	2	0.0000	13.010	NONE

Appendix 3.38

Attitudes Towards Pedestrianisation by Prefer to Park Elsewhere

Count Exp Val Row % Col %	Yes	No	Don't Know	Row Total
Yes	53 89.4 10.3 26.8	446 484.7 88.3 49.8	6 10.8 1.2 25.0	505 45.2
No	125 70.6 38.5 63.1	278 328.6 67.8 31.0	7 8.8 1.7 29.2	410 36.7
Don't Know	20 36.0 9.9 10.1	172 162.7 84.7 19.2	11 4.4 5.4 45.8	203 18.2
Column Total	198 17.7	896 80.1	24 2.1	1118 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
84.98416	4	0.0000	4.358	1 of 9 (11.1%)

Appendix 3.39

Attitudes Towards Pedestrianisation by Prefer to Park Elsewhere

Count Exp val Row % Col %	Yes	No	Don't Know	Row Total
Yes	106 153.1 10.1 39.8	934 872.8 88.0 32.3	20 24.1 1.9 64.5	1050 77.7
No	65 28.1 33.7 33.0	123 160.4 63.7 11.0	5 4.4 2.6 16.1	193 14.3
Don't Know	26 15.7 24.1 17.2	76 89.8 70.4 6.8	6 2.5 5.6 19.4	108 8.0
Column Total	197 14.6	1123 83.1	31 2.3	1351 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
89.06114	4	0.0000	2.478	2 OF 9 (22.2%)

Appendix 3.40

Attitudes Towards Pedestrianisation by Type of Shopper

Count Exp Val Row % Col %	Other	Recreational	Pure	
Yes	228 246.5 21.2 73.2	324 311.5 30.1 80.8	524 519.0 48.7 78.4	1076 77.7
No	56 45.9 27.9 47.7	48 58.2 32.9 11.5	99 96.9 49.3 14.8	201 14.5
Don't Know	32 24.6 29.6 10.4	31 31.3 28.7 7.7	45 52.1 41.7 6.7	108 7.8
Column Total	316 28.8	401 29.0	668 48.2	1385 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
9.80117	4	0.0439	24.641	NONE