# IMPROVING PEDESTRIAN ACCESSIBILITY AND QUALITY OF LIFE

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## 1. INTRODUCTION AND OBJECTIVES

In the UK walking has been in decline for many years, but is still an important mode accounting for around 25% of all trips in 2002 (DfT, 2003).

Walking has perhaps been partly overlooked by those responsible for urban areas because of its very ubiquity and the fact that it is seen as a benign mode of transport. By its very nature walking is something which virtually everyone does and which is self evidently an important mode, but which causes few problems to others and is relatively inexpensive to cater for. These advantages can sometimes lead to walking being overlooked as the more "obvious" modes, in terms of impacts and person kilometres travelled, are catered for. Hillman and Whalley (1979), concluded that:

*"in both transport policy and practice, it [walking] has been overlooked or, at the least, has been inadequately recognised."*

However, even after this report, there was little explicit National Government recognition that walking required consideration beyond simply providing facilities. The dominant consideration was safety, which led to a segregationist design philosophy. As the pedestrian was usually seen as the less important road user, this often meant that pedestrian convenience was sacrificed in order to remove the vulnerable pedestrian from the danger. The most extreme form of this approach was pedestrian subways and footbridges, but this philosophy also underlies the use of guardrails, pelican and other light controlled crossings.

This paper contains firstly an overview of the main pedestrian problems and the factors that influence both the decision to walk and routes taken derived from literature search. The second part of the paper examines results from a series of studies looking at methods for valuing different aspects of the pedestrian environment.

## 2. PEDESTRIAN CHARACTERISTICS

In much of the literature there is the recognition that pedestrians are not, and should not, be treated as a homogenous group. The criteria used to categorise different types of pedestrian are not always consistent between the studies. In most there is recognition that physical ability, social roles and economic constraints play a part in the experience of being a pedestrian.

Pedestrians with a physical impairment, such as walking, breathing or sight difficulties are often given as a group who have particular needs in the pedestrian and urban environment. Age is often used as another criteria. Both the elderly and the young are often mentioned

as particular types of pedestrian with different needs and interests. It should be noted that the reasons given as to why age is important are because age might have an impact on physical ability and cognitive skills as well as perceptions and feelings about the road environment and its safety and in addition relate to the social roles that the young and the elderly are expected to assume as dependents. There are also those users that are encumbered by shopping or pushing prams (Forward 1998). Further, those pedestrians that are travelling as a group composed of adults and children are often thought to have different needs and interests. Gender is another criteria for categorising pedestrians. There is some evidence that male and female pedestrians have different perceptions, needs and interests, Sharples and Fletcher (2000) for example, claim that the empirical work they conducted with regard to crossing facilities shows that valuations of different crossing facilities vary by age and gender. Intuitively this finding has some degree of truth as the needs and interests of male and female pedestrians vary just as the societal roles of men and women vary, for example more women than men work part-time and carry shopping and use buses. There is also evidence that people from poor or excluded backgrounds are more likely to walk than those from wealthier backgrounds, particularly if the household does not have access to a car (Living Streets, 2001). In addition studies have found that children from low-income backgrounds are more likely to experience higher levels of exposure to the road environment and a higher incidence of accident involvement (see Living Streets, 2001, Bly, Dix and Stephenson, 1999). Furthermore it is believed that ethnicity may also impact on walking needs and patterns although there is little research in this area.

## 3. PROBLEMS FACED BY PEDESTRIANS

Numerous surveys have asked pedestrians about the kinds of problems they face on our roads. Table 1 summarises the findings from a number of surveys.

Within this there is to some degree a hierarchy of problems which relates to severity and degree and longevity of effect, though also, perhaps surprisingly, there is no clear relationship between this hierarchy and the impact on levels of walking. At the top level of the hierarchy there are problems which impact on the health of the pedestrian both short and long term. Next there are problems which are to some degree perceptual, but which can have a considerable influence on behaviour. Finally there are issues to do with travel delays and inconvenience. Of the three, the first and third are most easy to obtain data on the scale of the effects, the second rather less so.

Table 1 Problems faced by pedestrians

| IHT (2000) – from MORI (1995) and NCC (1998) | Pedestrians Association, 2001 | NCC, 1979/80 | Edinburgh, 1993 |
|---|---|---|---|
| **A Poor quality pedestrian environment** | | | |
| Poor footway maintenance and lack of ice/snow clearance | Badly managed/maintained streets | Poor road surface | Damaged pavements |
| Litter and a general appearance of neglect | | Dirty streets | |
| Dog fouling | | | |
| Splashing by drivers | | | |
| Buildings that 'turn their backs' on the street, ugly street scenes and absence of surveillance | Street environment is grey and ugly | | Poor road environment |
| Cul-de-sac housing layouts that turn suburban estates into mazes and increase walking distances | | | |
| Lack of benches and public lavatories | Lack of basic amenities | | |
| Lack of road signs for visitors on foot | Lack of pedestrian information | | |
| Steep gradients and/or steps | | | |
| | Traffic is noisy/smelly | Dust/smell | Air pollution/Noise |
| | Roads designed for vehicles | | Too much traffic |
| **Inadequate pedestrian safety** | | | |
| Fear of road accidents | | | Fear of crossing roads |
| Aggressively designed vehicles and, at night, high powered headlights | | | Speed of traffic |
| Obstructions on footways: roadworks, rubbish bins and sacks, poorly sighted traffic sign poles, bus shelters, locked bicycles and parked cars | Footways blocked by obstacles | Obstacles | |
| Inadequate or broken street lighting | | Poor street lighting | |
| Lack of or inadequate footways – particularly in and between villages and the narrower streets of old towns and cities | Footways too narrow | | Congested footways |
| Illegal cycling on pavements and the sharing of some off-road paths with cyclists | Cyclists ride on footways | | |
| Inadequate green time at signal controlled crossings | Short times at crossings and often not located in right places | Problems crossing | Lack of crossings/long waits |
| **Inadequate personal security** | | | |
| Fear of assault, graffiti and withdrawal of police areas | Changes in policing priorities | | |
| Highly publicised child killings and abductions | | | |
| Dangerous dogs | | | |
| Intimidation from beggars and drunks | | | |

## 3.1 Health related problems

A number of specific health related problems are experienced by pedestrians and well reported in the literature.

**Road safety:** This is an area where considerable research has been undertaken and one in which reliable data (at least for more severe and fatal accidents) is available internationally. Figures show that in GB in 2000, 857 pedestrians were killed, 8641 were seriously injured and 32535 were slightly injured. 3226 of those killed or seriously injured were aged 15 or under. Rather less information is available on more minor accidents, particularly those involving individual pedestrians tripping on kerbs, though figures quoted in IHT (2000) based on work done by NCC (1987) suggest around 250,000 accidents per year caused by tripping/falling incidents on the walking surface, though no information is given on severity.

**Air quality:** Again there is considerable data available on air quality levels within urban areas, either modelled or measured. There are however considerable problems of interpretation and a limited understanding of exposure patterns of pedestrians to different air pollution levels. Research undertaken by the Committee on the Medical Effects of Air Pollutants (COMEAP, 1998) shows that significant numbers of people in the UK suffer adverse health effects (including premature death) from poor air quality. However, it is currently impossible to disentangle the extent to which these health impacts result from pedestrian activity compared to other activities. Some studies have shown that air pollution levels in vehicles are actually higher than those on surrounding footways (see for example the review by ETA, 1997).

**Personal security:** Whilst data exist in the UK on the levels of crime against the person, it has not been possible to separately identify that which occurs on the street to people as pedestrians.

**Inactivity:** The role of physical activity in maintaining good health and wellbeing is well known and increasingly receiving media and public attention. Clearly walking is one way in which an individual's level of activity can be increased. Current recommendations of activity levels to produce health benefits suggest a minimum of 20 or more occasions of moderate or vigorous activity of at least 30 minutes duration over a period of 4 weeks. A summary of possible risks associated with inactivity, in particular increased susceptibility to coronary heart disease, is given in Crombie et al (2000).

## 3.2 Perceptual problems

These are categorised here separately from health problems, though at the extreme it is possible that some of the perceptual problems could in the longer term contribute to health issues.

**Fear/intimidation/danger:** It is very difficult to quantify the scale of this problem and little research work exists to back up anecdotal evidence. Clearly the degree of fear, intimidation and danger is closely linked to perceived levels of road safety and personal safety, though perhaps not as well linked to the actual levels of risk associated with such problems. Fear, intimidation and danger are problems which range from extreme responses

for a small number of people to quite rational assessments of relative risk of particular locations by many. Much anecdotal evidence focuses on particular locations which are known to be 'dangerous', but which have very small or zero accident records, often because no-one will try to cross at such a location because of a recognition of the level of danger (or a level of fear or intimidation).

**Severance:** This is the divisive effects that infrastructure and traffic can have upon communities and upon the scope of individuals to move around within the urban area. It is particularly a problem which affects younger and older age groups, the former partly because of the degree of 'licence' permitted them by their parents (see for example work by Tate, 1997), the latter more resulting from the barrier effects of heavy and fast moving traffic. Very little work has been done which documents either the thresholds at which severance becomes a problem (one example is work by May et al (1985) which identified thresholds of activity based on traffic flow levels) or the overall scale and severity of the problem within the UK.

**Other low grade problems**: these can include things like mess, litter, broken pavements or the overall appearance of the street scene. Many such problems are based on a very personal assessment of a location and may change very rapidly over time, or be based on a formative experience. Other sensory inputs could also effect perception of a location, such as smell, fear of heights, claustrophobia or agoraphobia.

### 3.3 Inconvenience

**Pedestrian delay:** Issues here relate to delay arising from poorly placed street furniture and the size and width of pavements affecting level of service and road crossing delay. A reasonable amount of work exists which documents the scale of these problems. Evidence suggests that delay can, for short urban journeys, be a significant proportion of overall journey time, particularly where a pedestrian is forced to wait at a sequence of signal-controlled crossing facilities. For some user groups, especially children and the elderly crossing at non-signalised points in a busy road network can also be a considerable problem. There is anecdotal evidence that delays and frustration can lead to risk-taking behaviour and ultimately accidents.

**Land-use and planning effects:** Given increasing dependence upon the motor car and decentralisation of many aspects of urban areas many urban distances are increasing reducing the acceptability of walking for such journeys.

## 4. FACTORS AFFECTING THE DECISION TO WALK

### 4.1 Introduction

There are two main studies investigating the walking decision - both are comparative studies investigating mode choice between walk, cycle or drive for all short trips (Forward 1998, Mackett 2001). For those with a car available the decision to walk was made in the context of having the option to drive. This section identifies those factors that attract people to walking rather than the various merits and demerits of car travel. A range of other studies not directly concerned but of relevance to mode choice have been included, for example, the study of school journeys by Bradshaw and Jones (2000) and the study by Stradling (2000) on using interchanges.

## 4.2 Distance

**Distance or journey time**. The distance or time required for the journey is a factor referred to in many studies (for example IHT, 2000; Bradshaw and Jones, 2000; Mackett, 2001; Forward, 1998; Goodman, 2001; Partnership for a Walkable America; Hillman, 1999) in a variety of different ways, such as, saving time, the straightest line, time taken, or delay, but all report some concept of time involved in the decision making process and report it as a key determining factor. In addition studies of attitudes (Forward, 1998; Stradling, 2000; Hodgson and Tight, 1999) report 'convenience' which would appear to be often related to and confused with time taken and delay experienced. In a study of mode choice for short trips (Forward, 1998) travel time was identified as a factor in the decision to walk and if the individuals believed themselves to be 'in a hurry' they were less likely to make a walking trip[1].

**Ever-increasing distances**. Distance between services has grown and although the proportion of trips under 1 mile undertaken on foot is around 80% and has remained so for many years, the actual proportion of trips of 1 mile or under is decreasing[2]. (Living Streets, 2001).

## 4.3 Time

**Cultural values/social constructs of time**. Time is not a straightforward concept, it can be viewed as a natural phenomenon (such as the seasons or daylight); but it is also a social construct, for example, many of the time periods used in the workplace such as the week, the hour, the working day are all constructed periods of time. Perceptions of time are culturally defined and socially constructed and thus have many different values and meanings that vary between people, situations and across time (Virilio, 1986; McNaughten and Urry, 1998, Adam, 1995; Goodman, 2001). A number of different constructs of time have been identified of which Goodman (2001) argues that: lifecycle time; necessary time (involving the complex scheduling of routine and domestic tasks); work time; and travel time are useful for understanding the motivation to walk.

**Implications for walking**. These multiple conceptions of time interact to influence (and in part explain) mode choice and attitudes to walking and its attractiveness. In contemporary societies the view of time as a commodity and a valuable resource not to be wasted is part (at least) of the explanation for positive attitudes towards speed and the modes that seemed to be fast, that is, to save time. Thus any understanding of walking needs to take into consideration that people's view of time and the time they have available has not remained static. For some people who have very little time (they are time poor), for example, working mothers juggling caring and employment commitments, walking can be perceived as placing additional time burdens that they can ill afford. Evidence suggests that our perceptions of time have also made the time we have more valuable and that both these factors can affect the decision to be a pedestrian.

[1] This factor added to four others: night-time (relates to personal security); luggage (relates to effort and comfort); heavy traffic; and the weather were found to explain 25% of the variance in the decision to walk.
[2] This reduction in short trips may not be because the distances have grown, but may also be because the desire to use the car has grown

## 4.4 Security

**Personal safety.** Fears about personal safety are one factor that has been identified explicitly in empirical work as influencing both pedestrian route and mode choice. Studies have shown that some people do not walk because of fear of attack (Crime Concern, 1997, Hamilton 2000). This fear is different in character for men and women, children and adults, elderly and young, ethnic groups and for those with learning impairment and or physical impairment. There is also evidence that levels of fear are greater in urban areas and markedly higher in London compared with rural areas. Anxieties about personal security are particularly acute at night time and many people, women in particular, organise journeys to avoid having to walk at night (e.g. Forward 1998, Mackett 2001, Living Streets 2001; Hamilton 2000). In most studies night-time or the absence of adequate street lighting or dark spots where potential assailants could hide were mentioned as deterring people from walking. Other factors included the presence of people (individuals and groups) 'hanging about'. Shift workers such as nurses in particular go to extraordinary lengths to make sure that they are not walking or catching public transport at night (Burkitt, 2000).

**Security, safety and children**. Complex social trends have affected children's activities and particularly walking over the past twenty years. In recent years parents and guardians have come to fear that children will be attacked and abducted by strangers whilst in the street which has led to a restriction on children's freedom to play out. In addition there have been growing fears about the danger of road traffic that has meant that many more children are being escorted when they go out and not allowed to make journeys on their own. Hillman, Adams and Whitelegg (1990) found that parents restricted their children's freedom more because of their fears about road traffic than their fears about strangers assaulting their children. One result of these changes in perceptions and in the use and perceptions of time is that more and more parents are deciding that their children should be driven rather than walk to school (Bradshaw and Jones, 2000).

**Incivility.** Incivility actually seems to have a large impact on the transport system. Using the transport system by any mode involves a person in social interaction with other users. This social interaction involves implicit, unacknowledged agreements about what is considered to be polite or rude behaviour (both verbal and non-verbal) between people. There have not been any studies on the impact of incivility on modal choice, but there are reported incidences of 'road rage' arising through what seem like quite minor infractions of what is considered to be polite behaviour. Pedestrians have complained about drivers parking vehicles on pavements usually in terms of the nuisance and impediment it causes to their mobility, but these are also examples of uncivil behaviour. They demonstrate a lack of concern about other potential users of the transport system.

## 4.5 Road traffic

Road traffic type and volume is also given as a factor in choosing not to walk. Appleyard and Lintell (1972) found that in a comparison between three streets, the one with the greatest amount of traffic resulted in the least amount of contact between people living on opposite sides of the road in the same street. Road traffic can encompass a number of different elements as well as volume, such as speed and other behaviours. It is possible that emissions from traffic such as noise and air pollution also affect at the extreme the decision

to walk, though more likely it influences route choice, though no reported work on this has been found.

### 4.6 The urban form

There are some studies that argue that the form, that is the structure and shape of the urban environment, can impact on the decision to walk (Hass-Klau et al, 1994, Living Streets, 2001). Many argue that the urban environment should be designed and managed to make it an attractive space to be in so that people will be encouraged to socialise and use streets as 'living spaces'. This argument is principally because some authors claim that people attract other people. Hass-Klau et al (1994) report that people in mixed gender groups and mixed ages congregating around the edges of squares and sitting drinking and talking are very conducive to attracting other pedestrians. It is also clear that urban environments can take on forms that allow cars to dominate and discourage people from using them.

### 4.7 The pedestrian environment

There are some studies that suggest that the quality of the footpath and other facilities for pedestrians influence the decision to walk (Pedestrian's Association, 2000; Hass-Klau, Dowling and Nold, 1994; NCC, 1997; and Gehl, 1999). The particular factors identified in the studies are cleanliness, including the presence of litter, rubbish, dog dirt and the condition of the pavement. There is also evidence that provision for pedestrians in cities such as Göthenburg (Sweden); York (UK) and Portland (USA) is encouraging more walking journeys. There are some theoretical perspectives on social exclusion and power (Gaventa, 1980, Smith, 1999) that argue that the continual sight of shabby, poorly maintained equipment and facilities such as broken bus shelters or cracked pavements reinforces a feeling of neglect and inferiority compared to other road users.

### 4.8 Effort required

Two studies have reported that a further factor in choosing to walk is comfort (Forward 1998, Stradling 2000). Unfortunately in most studies comfort is never really understood or explained and in most cases it is also correlated with the weather. In Stradling (2002) effort rather than comfort was looked at in a study evaluating the use of public transport interchanges. In the study effort was defined as emotional (affective), mental (cognitive) and physical. Though this research looked at the decision to use public transport it indicates a useful way forward to consider effort in the decision to walk, in particular that all three aspects of effort need to be considered in the design process.

### 4.9 The weather

The weather often comes up in the lists of factors that people find significant in the decision to walk. Forward (1998) showed that for short trips dry weather had a positive impact on the decision to walk. It is not only the discomfort of walking in inclement weather that can deter people from walking but also the fact that one has to dress in the appropriate clothes for the weather. In a study on green travel plans a survey respondent described the teasing from colleagues when she uses public transport (which obviously includes an element of walking) for commuting to work, because she has to dress for the weather. She described how her colleagues would make remarks and laugh about her dress

such as ‘is it snowing out there’. She described herself as wanting to use a car to avoid being different (Hodgson, 2000).

### 4.10 Other factors

Those who already walk hold additional positive beliefs about the benefits of walking, in particular believing that it was good for fitness and health, was relaxing and gave one a sense of independence and freedom (Forward, 1998). Those who already routinely made walk journeys to commute also had positive beliefs about the time required to do the journey. Other factors identified with walking include the positive impact it has on a person’s psychological well-being. In the one article available on this, Hillman (1997) argues that walking calms the “whirling agitations into an organic rhythm”.

## 5. FACTORS INFLUENCING ROUTE CHOICE

There are few recent papers that focus on route choice, however, there are a number of policy documents that explicitly identify factors that are believed to act as barriers and obstacles to walking. Many of the factors already identified as influencing the decision to walk also influence route. This section therefore focuses on those factors not covered in Section 4. The review of the literature on pedestrians has identified four sub-categories relating to the interaction with the environment: pedestrian networks; the pedestrian environment; infrastructure provision and its management; and land use and urban form. There are two sub-categories of interaction with others and they are: interaction with other pedestrians (and particularly personal security) and interaction with traffic (see Table 2).

Table 2 Factors influencing routes by category and interaction

| Interaction | Factor category | Factor detail |
|---|---|---|
| Pedestrian Interaction with environment | Pedestrian environment | Surface evenness<br>Tactile signals<br>Footpath width<br>Gradient<br>Ramps<br>steps<br>Handrails<br>Guard rails<br>Street furniture (Obstructions)<br>Benches<br>Meeting points<br>Toilets<br>Carriageway width and no of lanes<br>Crossing placement<br>Crossing - distance removed from traffic<br>Crossing types: At grade pedestrian, Puffin, Zebra, Pelican, Toucan, traffic signal with ped phase, traffic signal without ped phase, (cycle phase etc), at grade: unsignalised, pedestrian subway, bridge<br>Drainage/puddles/car splashing<br>Cleanliness: Litter, Dog fouling, Graffiti |
| | Pedestrian network | Connectivity<br>Desire lines |
| | Urban form | Building blanks and back walls,<br>Functionality<br>Legibility<br>Sense of place<br>Scale: human or otherwise<br>Car dominance |
| | Land use | Location of services,<br>Mazes and street layout and distances |
| Pedestrian interaction with other traffic system users | Traffic | Volume, speed, composition<br>Headlights, fear, anxiety, intimidation, danger<br>Traffic accelerating to 'beat' lights |
| | Personal security | Other users<br>Intimidating behaviour/drunks |

## 5.1 Pedestrian environment: infrastructure and management

The pedestrian environment refers to the infrastructure, the geometric layout and the management of the transport system with particular respect to the provision for pedestrians, for example, footpath width or the unevenness of the surface and the crossing facilities. Disabled Rights groups in particular have argued that it is important to take the very detailed characteristics of the pedestrian environment seriously in order to understand pedestrian route choice. What can seem to be a relatively minor factor in the pedestrian environment, such as pavement cracking, can actually cause people with a physical or visual impairment a lot of extra effort and trouble to surmount. One factor within this category that may at first seem unusual is toilets. There is an argument that toilets should be included as a factor of the pedestrian environment. For some people, particularly elderly pedestrians, women and those with young children toilet location is taken into consideration when deciding on routes (Living Streets, 2001).

## 5.2 Traffic

A number of characteristics relating to the interaction and presence of traffic have been identified in the literature including volume, speed and composition of the traffic flow. In addition the recent guidelines on planning for pedestrian journeys (IHT, 2000) identified 'aggressive' headlights as another possible factor in choosing a route to walk. A study in the UK on use of zebra crossings (Sharples and Fletcher, 2000) showed that users expressed uncertainty about the behaviour of the oncoming traffic, particularly whether the traffic would slow down for the pedestrian, and this made using the crossing facility less comfortable. Another aspect of traffic is parking, specifically people using pedestrian facilities to park their vehicles – it is already known from lobby groups such as the Pedestrians Association and Disabled Rights lobby groups that parking on footpaths and impeding pedestrian movement is considered to be an impediment and nuisance (Living Streets, 2001).

## 5.3 Pedestrian network

Studies have shown that there are two factors concerned with the network of footpaths that influence route choice, the first is whether the footpath is part of a network providing good connections, crossing points and access to services and the other is whether the facility (footpath or crossing) is implemented according to the desire lines of pedestrians. These two are interrelated although direct and shortest time should not be confused. There is some agreement among the studies that pedestrians choose the straightest path and that the time taken to reach a particular destination is part of the calculation, for route choice. Sharples and Fletcher (2000) found in their study that in those locations where a crossing facility was not on the desire line pedestrians chose not to use it.

## 5.4 Urban Form

A car dominated urban form is given as a factor in some studies, in particular DETR (2000) cited it as a strategic factor in choosing routes and also to walk. However, there is little agreement on exactly what is meant by 'car dominance' particularly as there are so few studies that have actually investigated this factor. It is possible that it means both the actual quantity of land given over to car traffic and also the priority that it is given (e.g., traffic signals settings which prioritise the car traffic rather than the pedestrian), but it could also refer to the extent to which cities and urban form are built around and to accommodate the car. Scale of the built environment in relation to human scale is also important.

## 5.5 Land use

Land use is thought to affect route choice in that the location of services impact on where pedestrians actually walk. In addition there are some street layouts that also impact on pedestrian route choice, for example, housing estates incorporating a maze of roads in their design and thus increasing distances travelled. In addition evidence is frequently presented that the trends in land use patterns mean greater distances to travel to access services thus affecting both mode choice and route choice. Land use, urban morphology and pedestrian networks are all inter-linked (Living Streets, 2001; Hillman, 1999; Walk21, 2000; Adams, 2001).

### 5.6 Familiarity

Familiarity clearly influences route choice to a degree, but it is largely missing from the literature, perhaps because it is a factor to do with the individual and not to do with the provision. Familiarity can be thought of in two ways: firstly resulting from regular exposure to a route and secondly in the sense of the legibility of urban form (that is one may not have been there before but the sense of place is one that is recognisable and the individual elements and their relative position is familiar). Another aspect of familiarity that may influence route choice is that of being able to predict the characteristics of the flow of traffic and the level of confidence that the pedestrian has in that set of expectations.

### 5.7 Positive factors, attractors, facilitators

There are a number of factors that are not particularly well represented in the literature, namely those associated with attracting people to particular routes. For example, the presence of others and their behaviour has been mainly researched in terms of what kind of behaviours deter people from a particular route, but there is less work on how and what kind of behaviours attract people to use particular routes.

### 5.8 Single, cumulative and combined effects

Existing studies have considered and tried to estimate the impact of factors singly (Sharples and Fletcher, 2000) but there is little evidence that they have considered the cumulative or the combined effects of factors. It would seem reasonable to question whether factors assume different levels of influence when combined. In addition there is little work on the cumulative effects of factors. Common sense would suggest that prior experience, that is, what has gone before during a walk journey, could have an impact on the influence of future factors, that is, what comes after. To put it another way, can there be a situation in which a minor factor assumes greater or lesser importance because it is one in a long line of factors experienced on that journey. Further work is required to establish the length of time over which to estimate such cumulative effects. Finally if a factor is considered to be a barrier then it may be the case that its removal would facilitate walking. However, little work has been done to establish if this is indeed the case.

## 6. QUANTITATIVE SURVEYS

Sections 4 and 5 highlighted the main pedestrian problems, characteristics and factors that influence both the decision to walk and routes taken. The next stage was to determine which of these wide-ranging pedestrian factors were the most important to pedestrians, so that a subset could be selected and investigated further. The research had been designed so that the physical elements of the pedestrian environment and the attitudes to walking could be researched separately and then brought together in the form of a tool that would allow decision makers to value a walking route based on the project findings. This paper mainly considers the quantitative survey work that was completed to investigate the physical elements of the pedestrian environment.

### 6.1 An importance survey

A survey was developed to further explore with pedestrians the importance of a range of factors derived from the literature review. This was sent to 2000 residents in Leeds and York. This survey incorporated both factors specific to the pedestrian environment and pedestrian characteristics identified in the literature review including age and gender. The respondents were asked how important each pedestrian factor was to them in their walking environment using a 5-point semantic differential scale ranging from not important to extremely important. In total 47 factors were considered ranging from dog mess to sense of community.

The data were analysed using general linear modelling to ascertain the influence of key socio-demographic variables, which included gender, age, ethnic group, income and home location. One of the most interesting findings was that, with a significance level of 0.953, opinions about the variable 'dog mess' were universally highly negative and did not change according to gender, age, income or home location.

The importance survey determined that the factors rated as extremely important by over 30% of respondents were; street lighting, safe crossing places, cyclists not using the road and improvements to dog mess, dirty pavements, litter and graffiti. Factors rated as being extremely important by 20% and 30% of the respondents were: smooth pavement surfaces, obstruction free pavements, local shops, pavement drainage, low vehicle speed, dogs on leads, space to walk at your own pace, no gangs of youths, ease of crossing the road and feeling like the pavement network was designed for pedestrians. The work highlighted the wide range of factors that are important to pedestrians when they are walking.

### 6.2 Econometric Surveys

Using the outcomes from the importance survey the next stage of the research was to conduct extensive econometric survey work to determine exactly how important or what value pedestrians place on different factors. A survey of methods that would allow a monetary value to be determined for the identified pedestrian factors was conducted. The three candidate methods chosen for trial were:

- Contingent Valuation
- Stated Preference
- Level selection technique

These three techniques utilise different methodologies that can be used to elicit monetary valuations for the different factors affecting the attractiveness of a pedestrian route. The aim of the studies was to determine which of these three methods would provide the most appropriate method of eliciting values for the pedestrian environment from members of the public. The following three frequently mentioned pedestrian factors were selected for the trials:

- Pavement Quality
- Dog mess/litter
- Pavement Obstructions

Around 25 respondents were involved in each survey.

**Contingent Valuation**

The contingent valuation technique involved asking respondents how much extra they would be willing to pay in monthly council tax to improve each of the three pedestrian factors in their area and how they felt about doing this. Figure 1 provides an example showing the question relating to pedestrian obstructions.

One of the improvements that could be made would be to reduce the number of obstructions on your walk. Pictures A and B provide some examples of obstructions currently faced by pedestrians. By raising local taxes it could be possible to enable obstructions to be moved to less intrusive locations where possible.

Picture A

Picture B

Picture C

Considering the scenario and your household income how much would you be willing to pay to reduce the obstructions you face to a level equivalent to picture C where walking is not restricted and the street furniture is not located on the pavement? £_____

**Figure 1: An example question.**

The results of the questions are provided in table 3 and indicate that people were willing to pay more for a dog mess/ litter free environment than the other two pedestrian factors.

Table 3 Contingent valuation results

| | Pavement quality | Obstructions | Dog mess/litter |
|---|---|---|---|
| Mean | £14.13 | £11.57 | £16.43 |

The contingent valuation pilot study highlighted a number of issues. This method was easy to implement as it involved asking the respondents for the value that they would place on each factor in the pedestrian environment and getting a straightforward monetary valuation back. It also allowed respondents to consider a walk that they currently complete so basing their decision on a real life situation. However, the survey participants found it difficult to link the figures that they were being asked to give to reality. This encouraged widely different answers such as £0 for those who felt that they currently paid enough council tax to answers where £200 was offered for the removal of all dog mess and litter from their environment.

**Stated Preference Study**

The stated preference technique involved asking respondents to choose between two hypothetical walking routes. The aim of this method was to infer a persons willingness to pay for particular pedestrian factors using the values inferred by the hypothetical choices

or trade off that they make. An example of one of the choices presented to the respondents in the pilot study is provided in table 4.

Table 4: Example of one of the hypothetical route choices

| Characteristics of the routes | Route A | Route B |
|---|---|---|
| The percentage covering of the largest obstruction along any point of the route | 25% | 75% |
| The number of incidences of litter/ dog fouling along the route is | 2 | 6 |
| The percentage of the pavement that has an uneven walking surface is | 50% | 50% |
| The Council Tax increase would be | £6 | £3 |

The respondents were asked whether they preferred route A or route B or whether they would prefer neither. A partial factorial orthogonal design was constructed using the method described in Hahn and Shapiro (1996). The pedestrian factors were each given three levels (each indicating the difference shown between the two routes) in the design and the council two levels (see table 5). The example in table 4 shows a difference of 50% between routes A and B for the obstruction factor in this choice set. This combination of factors and levels resulted in nine sets of route choices for the public to choose between.

Table 5 Stated Preference design

| Factor | Difference levels(Difference between the two routes) | Range of values presented in the choice sets |
|---|---|---|
| Obstructions | 50%<br>25%<br>0% | 5% - 80% |
| Litter/dog mess | 4 incidences<br>10 incidences<br>0 incidences | 1 – 13 |
| Pavement quality | 20%<br>50%<br>0% | 5% - 80% |
| Council tax (monthly increase) | £3<br>£5 | £1 - £12 |

The results of the analysis (using logit modelling) showed that all factors except the council tax were found to be significant. The method used for obtaining a monetary value for each of the factors is obtained by dividing the coefficient of the factors by the council tax coefficient. With the council tax coefficient not being significant this leaves some doubt as to whether the monetary values produced are realistic. However the results achieved are presented in table 6 as a benchmark for future attempts to value pedestrian factors using stated preference techniques. They show that the respondents were willing to pay £5.99 for every reduction in litter/dog mess along their route. The results also show, as with the contingent valuation results, that the removal of dog mess and litter is the most important of the three factors to pedestrians.

Table 6 Stated preference results

| Factor | Monetary value |
|---|---|
| Obstructions | 76.8p for every 1% reduction in obstructions |
| Litter/dog mess | £5.99 for every reduction in one unit of litter/dog mess |
| Pavement quality | £1.42 for every 1% improvement in pavement quality |

This work was a first attempt at determining what levels should be chosen to value features of the pedestrian environment, as previous work was not able to provide any guidelines. In order to increase the significance of the results the council tax element of the choice set needs to be reconsidered. Possible solutions to this could be that more levels should be considered and a wider range of monetary values used if this method were to be taken further.

The respondents liked this questionnaire because it provided all the information that they needed, unlike the contingent valuation questionnaire. In this option only three pedestrian factors were being analysed. In the main survey this number was increased resulting in an increase in the number of choice sets that respondents had to complete. A possible problem would result from increasing the number of choice sets from the 9 used here as respondents felt there were too many choices to make.

**Level Selection Technique**

The final trial used the level selection technique, which is an adapted priority evaluator method. This involved presenting the pedestrian factors along with time savings (as a measure of monetary value) in a grid format as shown in figure 2. The columns represent the different pedestrian factors and the rows the different levels of the pedestrian factor. The original three pedestrian factors were included to maintain consistency across the studies with an additional factor of car speed. This format allowed pictures of the different levels to be used where available.

The method involved asking respondents to consider a route that they regularly made and to identify the box in each column that best represents that route in terms of traffic speed, obstructions, litter /dog mess and pavement quality. This showed their initial situation. The respondents were then told that they could improve one aspect of the pedestrian environment by one box or receive a 3 minute time saving on their journey. The chosen boxes and those options that were worse than the initial selection were then not available to be selected. They then either selected a box that was an improvement or selected the 3 minute time saving. The box selected was then not available to them and they were then asked what would be the next improvement (or time saving) and so on until all boxes had been selected. This enabled a relative valuation to be made based on which improvements were chosen and when in relation to the time saving available.

The respondents found the process hard to understand, but a subsequently developed computer based format was found to be easier. In this version when the respondents had selected their choices these were then eliminated from their screen and the computer allowed only one improvement to be selected at a time. The method allowed the respondents to consider their own route and so base their results on reality. The

respondent's comments indicated that a large proportion of the sample did not find the time savings to be realistic and they did not feel at all time constrained.

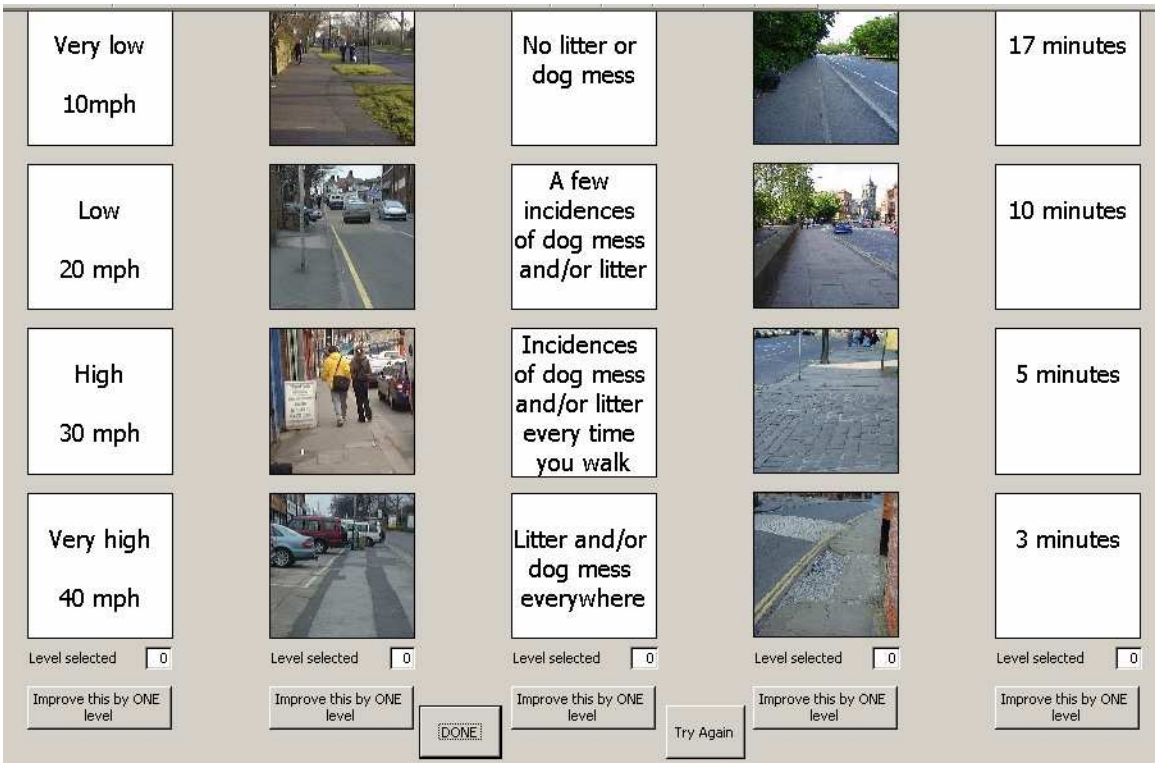
A paper based version was tested using University students who were taken on a specific walk and then asked to fill in the survey so that the same route was being valued. The results showing the initial route selection on the grid is provided in table 7. These results show the differences in how people perceive the pedestrian environment along a route.

Table 7 Level Selection Technique initial score level

| | Car speed | Obstruction | Litter/dog mess | Pavement quality |
|---|---|---|---|---|
| Mean | 2.81 | 2.96 | 2.19 | 2.78 |
| s.d | 0.79 | 0.65 | 0.48 | 0.80 |
| Mode | 3 | 3 | 2 | 2 |

The main problem with the level selection technique as applied is that the rules of the questionnaire introduced linear dependency. Modifications to this method of allowing respondents to improve their pedestrian environment by more than one box would reduce this problem and should be used in subsequent studies.

**Figure 2 Level Selection Design**




## 7. CONCLUSIONS

When starting the pilot studies it was thought that the three methods would be compared by the economic values that they produced. This was not eventually the case. The contingent valuation produced a large value for each of the factors and was not specific to

small improvements in the different factors due to the vagueness of the questioning technique. The choice experiment results were based on the assumption that the coefficient for the monetary value (council tax) was significant and this was not found to be the case in this experiment. Due to the linear dependency imposed by the level selection technique no monetary values were obtained for this method. What can be compared is that where monetary valuations were achieved both the contingent valuation method and the stated preference technique results ranked the three pedestrian factors in the same order of importance.

From the results it was decided to take the stated preference technique forward in a fuller study to determine the pedestrian values for the valuation tool. The reasons for this decision were that the analysis method is in place, it is possible to include more factors in the analysis and provide valuations for the different levels for each of these pedestrian factors. The negative aspect of using this method is that it is based on hypothetical routes that the respondents will have to imagine to be able to answer. The factors that need resolving are what levels / number of levels should be used for the monetary factor to ensure that it is significant and how many choice sets can the respondents cope with completing, as this will affect the number of pedestrian factors that can be included in the study.

People found it difficult to answer questions about walking and it became clear that people think about walking in a qualitatively different way to other forms of transport. Anecdotal evidence suggested that walking was not really regarded as a mode of transport in the same way as car or bus. Walking was considered less way of getting from origin to destination and more as a way of experiencing the local environment. This was entirely understandable, but did mean that aspects of walking were conflated with concerns about the local environment as a whole.

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