Accessibility and user needs: pedestrian mobility and urban design in the UK

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It is over 18 years since the UK Disability Discrimination Act legislated for access in Britain’s built environment and in transport services. A decade on, the Manual for Streets signalled a rebalancing of the hierarchy of movement towards the pedestrian, redressing the dominance of the car and transport engineer in ensuring effective flow of traffic. The notion of social inclusion in transport also brought into play wider consideration of how the built environment, fear of crime and other barriers conspire to restrict mobility and access to public transport. This paper critiques access in the UK’s urban environment and to formal transport, including an assessment of design and planning guidance in the form of toolkits and models which have been developed in this period to assist transport and urban planners and designers in street and transport service provision. This will draw on a 6 year study of accessibility and user needs in transport with a focus on urban design and social inclusion. A street design audit approach will then be outlined, which responds to these access imperatives and seeks to join up the whole journey environment.

1. Introduction

It is acknowledged that community safety, accessibility and social inclusion have emerged as particular challenges to the design of the urban environment, raising a wide range of issues affecting mobility and participation in everyday life (Evans, 2009). Accessibility in this context relates to the ability to reach destinations from home and therefore access to pedestrian and transport systems. In Britain, however, ‘accessibility’ has largely been limited to removing particular barriers such as to wheelchair access (although less than 8% of the registered disabled are wheelchair reliant) by providing facilities, for example step-free stations, low-floor buses, dropped kerbs, and ambient factors such as lighting, auditory and visual information and wayfinding. Inclusive design, on the other hand, is more of a process, with a multiplicity of stakeholders in the public realm and one that should include in the words of Walker: ‘all people regardless of age, gender, race or disability, encompassing management, operation and information and relating to all areas – the built environment, transport, graphics, telecoms and products. This is quite different from some iconic perfect and immutable product or design’ (Walker, 2005: p. 103).

The UK’s urban environment and transport system has also been fragmented in policy both, operational as well as in ownership terms, and between different design cultures. Or more accurately, transport policy and planning have been too isolated from urban policy and planning. In practice this is exacerbated by spatial scales and public and private interests. An example of this is the territoriality between street and transport facilities which frustrates integrated land-use planning and access. Design-related disciplines with an interest in the urban environment and transport system include: architects; urban designers; street, traffic, highways and civil engineers; as well as product, communications and industrial designers; and professionals with a responsibility for land use, housing provision, transport and safety – notably town and transport planners, street care teams, the police – crime prevention officers, safer neighbourhoods teams – and specialist advisers such as access and disability auditors. Defining the field and the scope of accessible transport from an inclusive design perspective is therefore best conceived in terms of the ‘whole journey environment’, since as Coleman observes: ‘a journey can be seen as a chain of individual products and services whose accessibility is only as strong as its weakest link’ (Coleman, 2003: p. 132). In making travel decisions, it is not usual to differentiate between the elements of the journey but on the individuals perception of the whole journey: ‘a broken paving stone under a failed street lamp is a deterrent to walking – it is of no use to say “as much as” or “more than” or “less than” fear of attack; if the environment stops someone from walking, it is not a matter of degree’ (Crime Concern and Transport and Travel Research, 1997: p. 22). In practice, standards in accessible design tend to isolate particular elements such as the design of building features ingress/egress (Disability Discrimination Act 1995 (1995)) not if and how the user actually reached the destination itself, or whether transport is integrated with service delivery, such as opening times. Access audits and guidance reflect this emphasis on buildings and their immediate environment, rather than whole journeys or...
transport routes, for example British Standard BS 8300: 2001 
Design of Buildings and their Approaches to Meet the Needs of 
Disabled People (BSI, 2001).

2. Accessibility and inclusive design

Official benchmarks classify a service or activity as ‘accessible’ if 
it can be reached at reasonable cost, in reasonable time, and with 
reasonable ease. ‘Reasonable’ in this context is not, however, 
defined (this same term is also used in Disability Discrimination 
Act legislation), with this value judgement decided by the 
provider (e.g. facility or transport operator) not the user, let 
alone those most excluded from travel and transport. Particular 
attention has therefore been paid in the present research to 
perceptual and safety issues, since these present one of the major 
barriers to access for excluded groups – with over 11% of the 
general public saying that they would travel more if they felt safer 
on the transport system (Crime Concern, 2002). Although crime 
and safety within the transport system (on board, at stations and 
bus stops) has received attention from police and transport 
operators (e.g. closed-circuit TV (CCTV), security), safety is of 
more concern and crime a greater barrier to access in the journey 
to and from transport by all people, but particularly women. 
According to a Home Office commissioned study, CCTV has 
also been found to be less effective in actual crime prevention and 
victim protection, than in reporting and detection – and only 
significant in crime reduction in enclosed spaces such as car parks 
with improved lighting and security guards (Welsh and 
Farrington, 2008). CCTV does, however, account for over 75% 
of all spending on crime prevention in the UK, whereas 
investment in improved environmental design, lighting and 
community safety would more directly address fear of crime and 
situational crime prevention. Despite the highest number of 
cameras per capita, the UK has not produced lower street crime 
than countries without such CCTV coverage. In reality, unless 
CCTV cameras are monitored in real-time and located close to 
areas under surveillance (many are not), they offer no protection 
to potential victims, while perpetrators either disguise themselves 
or ignore cameras over time. Good quality (required for 
prosecution) and monitored CCTV is also expensive to maintain, 
and presents an opportunity cost for actual street presence by 
police officers. More vulnerable groups and those who rely more 
on walking (i.e. older and younger people) frequently cite the 
safety factor, including fear of crime, as the highest in 
determining their travel behaviour. This is not confined to 
particular groups however; in general livability studies, low crime 
and safety rank highly along with specific environmental factors 
(Figure 1; BVPI (2007)).

At the micro-scale, responsibility rests primarily with the street 
or traffic engineer with the emphasis (or priority) given to 
vehicular road access and movement, and safety in terms of 
pedestrian and road/vehicle interaction, namely accident pre-
vention. Crossings and car speed are key limitations to 
pedestrian access: ‘roads are often perceived as barriers to the 
day-to-day movements of older people … Road traffic can lead to 
a perceived danger of travel, which causes feelings of insecurity, 
anxiety and stress’ (WHO, 2002: p. 12). Communities living in 
more disadvantaged areas are one and a half times more likely to 
be killed or injured on the roads than those living in more affluent 
areas, children under 16 over four times (DfT/DCLG, 2007). 
These communities are less likely to have access to a car and 
therefore the pedestrian and public transport system is of greater 
importance, as is community safety.

Only in recent years has the street (as opposed to the road) as a 
pedestrian environment attracted transport, design and safety 
attention, as a stimulus to increased walking and pedestrian 
activity. This has been driven by the twin goals of sustainability 
through more compact, walkable cities (Cooper et al., 2009) 
resulting in reduced car use, crime and pollution, and the health 
benefits from increased physical activity countering ‘obesogenic 
environments’ (Handy et al., 2002; Heath et al., 2006; Lake and 
Townsend, 2006). As Badland and Schofield concluded (Badland 
and Schofield, 2005), fostering suitable urban environments is 
critical to sustaining physical activity levels, and well-designed 
streets can provide part of the solution to improving health 
outcomes, with density, connectivity and mixed use being key 
contributory urban design features. In the UK recent efforts to 
fill this knowledge gap include design guidance and toolkits to 
measure accessibility at the street level, and guides to facility 
design, particularly to meet disability access and related building 
and planning regulations; these are summarised in Table 1. 
Various audits have therefore been developed in order to look at 
the quality of the street environment objectively, from both 
aesthetic and accessibility perspectives, including heritage and 
town/landscape (English Heritage, 2008). These have also been 
required to support proposals for capital funding to local 
highway authorities (transport asset management plans) and 
imcreasingly form an important element in place-making and 
urban design (KCC, 2010). The Transport Ministry’s Manual for
<table>
<thead>
<tr>
<th>Toolkit source</th>
<th>Aim</th>
<th>End-user involvement</th>
<th>Method</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link and Place</td>
<td>Planning and design of urban street as a Link – a place that users</td>
<td>Stakeholders are involved (‘key’), which takes</td>
<td>Step 1 matrix assigns up to five categories to Link and five for Place</td>
<td>Labour intensive – a matrix must be drawn up to include each street</td>
</tr>
<tr>
<td>Jones et al. (2007)</td>
<td>should pass through as quickly and conveniently as possible; and</td>
<td>into account priorities such as bus routes and</td>
<td>for each street/segment. Step 2 develops a Street Plan, a design</td>
<td>and sub-segment. Then street plans, giving the ideal design are</td>
</tr>
<tr>
<td></td>
<td>Place – as a destination in its own right – equally important. Aims</td>
<td>may also vary by time of day or day of week. The</td>
<td>brief for the area, setting out priorities. Step 3 involves a review</td>
<td>prepared followed by an evaluation of critical streets to see how</td>
</tr>
<tr>
<td></td>
<td>to meet varying needs of street users and encourage active</td>
<td>guide offers practical tools and approach to this.</td>
<td>of key streets in the area against the ideal set out by the design</td>
<td>well they fit this design. Multiple iterations may be required.</td>
</tr>
<tr>
<td></td>
<td>stakeholder engagement.</td>
<td></td>
<td>process, and identification of areas for change.</td>
<td></td>
</tr>
<tr>
<td>Spaceshaper</td>
<td>Toolkit for public engagement, for use by anyone – whether a local</td>
<td>User group (self-selected, e.g. friends group)</td>
<td>Questionnaire plus workshop to obtain information on the quality of</td>
<td>Relatively little effort beyond the time taken to fill in the</td>
</tr>
<tr>
<td>CABE (2007)</td>
<td>community group or a professional – to measure the quality of a</td>
<td>led by a trained facilitator. Data analysis</td>
<td>a public space before investing time and money in improving it.</td>
<td>questionnaire and conduct the workshop and site visit. Further</td>
</tr>
<tr>
<td></td>
<td>public space before investing time and money in improving it.</td>
<td>relies on algorithm/model.</td>
<td></td>
<td>effort required to collate the results obtained. Further iterations</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>A systematic process to assess the pedestrian environment. Establishes</td>
<td>Transport agencies and local transport</td>
<td>Relies on the collation of comments and scores on a range of parameters</td>
<td>can be undertaken with the same or different groups.</td>
</tr>
<tr>
<td>Evaluation Review</td>
<td>the relative quality of different pedestrian routes and provides an</td>
<td>authorities involved with the development and</td>
<td>to assess the pedestrian environment. Audit framework to assess the</td>
<td></td>
</tr>
<tr>
<td>System (PERS)</td>
<td>opportunity to review at a detailed level the opportunities for</td>
<td>validation. Not end-user based.</td>
<td>links, crossings, routes, public transport waiting areas, inter-change</td>
<td></td>
</tr>
<tr>
<td>TRL (2007)</td>
<td>improving individual links and crossings.</td>
<td></td>
<td>spaces and public spaces used by pedestrians.</td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td>Evaluates the quality of public space and identifies issues of the</td>
<td>Local participants guided by facilitator. Feedback</td>
<td>Relies on the collation of comments and scores on a range of</td>
<td>All routes of interest need to be audited. Expert judgement based.</td>
</tr>
<tr>
<td>Street Audit</td>
<td>people who use the streets and determine what needs to be done to</td>
<td>provided to participants.</td>
<td>parameters to assess the pedestrian environment. Facilitator takes</td>
<td></td>
</tr>
<tr>
<td>Living Streets</td>
<td>improve areas and routes.</td>
<td></td>
<td>people out to look at how places work on foot. No questionnaires,</td>
<td></td>
</tr>
<tr>
<td>(2002)</td>
<td></td>
<td></td>
<td>but observation and conversation encourages a fluid, natural</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>response to the street environment. Can be carried out by members of</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the public, local stakeholders or by consultants who wish to</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>assess the existing walking conditions of the local street</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>environment.</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Selected toolkits for street design and accessibility (continued on next page)
Streets (DfT/DCLG, 2007) in particular signalled government’s acknowledgement that the pedestrian should be at the top of the ‘hierarchy of need’ in the public realm, drawing on growing good practice in street design and layout schemes. Design guidance referenced in this manual is also generally predicated on new-build or major works. However, the vast majority of development is incremental, retro-fitting and infill of existing built environments, including existing transport services and routes. This manual was extended to encompass busier thoroughfares and high streets (CIHT, 2010) where greater interaction between ‘Link’ (movement) and ‘Place’ (destinations) is experienced (Jones and Boujenko, 2011). In London, the Roads Task Force has identified nine road types (TfL, 2013), from those dominated by vehicular traffic to those more pedestrian focused, distinguished largely by speed limits. Again, user involvement and consultation does feature in this road-led strategy which does not place the pedestrian at the top of the hierarchy, and is based on growth and regeneration with higher densities, which the author would argue requires a more sensitive and qualitative understanding of how streets are perceived and used, and would ‘join up’ across all road types and the whole journey environment.

Design guidance generally, including crime prevention and safety, has tended to focus on access and layout of buildings, notably Secured by Design (Colquhoun, 2004), Design Quality Indicator (www.dqi.org.uk/), and also open space (CABE, 2007). However, the more complex pedestrian journey and transport access has not undergone the same level of inclusive design analysis. The ‘Link and Place’ guidance perhaps offers the best resource from these available toolkits, distinguishing between movement and ‘attractors’ where pedestrians congregate, although it should be noted that all elements in the journey chain and street represent ‘places’ and diversity of space use and distribution of pedestrian activity also need to be recognised. Wider community and user involvement in these professional guidelines and toolkits is also weak, with an overemphasis on physical environmental and street features leading to prescriptive design standards, but less consideration of safety and other perceptual barriers or the needs of particular excluded groups (including mobility-impaired, hard-to-reach and infrequent users). Comprehensive community profiling and mapping is not a feature of these approaches, with the exception of the accession model promoted by the Department for Transport (Table 1) that relies on periodic national census and other official (e.g. multiple deprivation) data, but which again does not target perceptual fear of crime and local knowledge factors that, as has been found, determine accessibility within the urban environment and to transport. Pedestrian evaluation systems have also been found to be inadequate in assessing design against crime within the transport system (personal communication with John Strutton, Crime & Disorder Partnership Manager. Community Safety, Enforcement & Policing Directorate, Transport for London, 2008).

<table>
<thead>
<tr>
<th>Toolkit source</th>
<th>Aim</th>
<th>End-user involvement</th>
<th>Method</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within reach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accession</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department for Transport</td>
<td>Criteria can be added: frequency, speed, delay for wheelchair start/end times.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="http://www.accessiongis.com">www.accessiongis.com</a></td>
<td></td>
<td>Accession is designed so that data can be shared within partnerships and users, but data is not end-user or consultation based.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data on population, transport and local services and modeling of access and catchments. Suggests most data can be collected from national sets but local knowledge is beneficial. Requires effort to learn how to use program.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toolkit source</td>
<td></td>
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</tbody>
</table>

Table 1. Continued
Accessibility as a feature of sustainable development (ODPM, 2003) has also been a key element of quality of life (QoL), measured through a basket of indicators applied at a local level (DETR 1998 and see Figure 1). These include access-to-services indicators represented by journey (walking) times to a predetermined destination, such as a local general practitioner (GP) or park, but from the author’s user consultations it appears that these do not reconcile with the everyday destinations undertaken or most desired (Table 2). What is also common between these physical design audit and planning standards is the absence of user involvement in their specification, or the recognition that travel and mobility needs and behaviour vary according to demographic make-up, at different times, and for different environments. As Ekblom (2006: p. 3) observes in the case of crime prevention through environmental design (CPTED): ‘the efficacy of CPTED can be reduced by demographic factors and socio-economic factors. Social conditions may nurture fear, reduce the inclination to intervene and result in the withdrawal of people into the home’. What emerges is that the interaction between local residents, other users (workers, visitors) and the local environment requires a fine-grain level of analysis which might also inform higher scale urban design and planning of the street and transport system.

3. User perspectives
In transport accessibility measurement, public transport standards (TfL, 2003) use average travel journey times/distances between two points, namely from a point of interest (POI), origin or destination, to a service access point (SAP), such as a bus stop. These are then combined with the frequency of service or waiting time to make up the average ‘access time’. In London, for instance, an acceptable POI to SAP is estimated at a maximum of 8 min (or 640 m) to a bus top and 12 min (960 m) to a railway (including light rail, underground) station. This is based on a walking speed of 4-8 km/h (or 80 m/min). Such standards take no account of walking abilities, environmental ‘street’ factors, or a priori perceptual and personal barriers to travel, nor whether the local public transport actually serves the journey need (i.e. route/destination). From the author’s user surveys, for example, trips that involve multi-mode and interchange usage (e.g. two or more buses) present particular difficulties for older people and others with multiple mobility issues, notably pushchair and wheelchair users. The absence of street seating (or inadequately designed benches) and inadequacy of bus shelters (capacity, seating, leaking) were frequently cited problems (and see Passenger Focus on bus passengers’ experience, 2013).

As the first step in specifying accessible design from a user perspective, several focus group sessions were held with groups with specific mobility needs and those experiencing potential transport exclusion, for example, young people, mothers with toddlers, single parents, registered disabled, and ethnic minorities, including older and young people (SEU, 2003). These sought to evaluate the travel activity, aspirations and barriers to access, which could then be compared with minimum transport planning standards and QoL indicators. Focus groups were held in contrasting locations and communities in northern and southern England, including Rotherham, Liverpool, Camden, north London and Hertfordshire. A key finding from the older groups consulted was an assessment of their regular travel needs, and these were consistent across the locations and groups involved (Table 2).

Whereas national benchmarks focus on GP/hospital and town centre access, as well as sports facilities, the most frequent trips by older people were to local amenities such as the post office and food stores such as the greengrocer (Table 2). This is

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
<th>No. of journeys</th>
<th>National accessibility indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food shopping</td>
<td>Weekly</td>
<td>2</td>
<td>Percentage of households and households without access to a car within 15 and 30 min of a major centre by public transport</td>
</tr>
<tr>
<td>Comparison shopping</td>
<td>Monthly</td>
<td>2</td>
<td>Percentage of the population within 20 min travel time (walking) of different sports facility types</td>
</tr>
<tr>
<td>Social or recreational activity</td>
<td>Weekly</td>
<td>2</td>
<td>n/a</td>
</tr>
<tr>
<td>Structured daytime activity appropriate to need</td>
<td>Weekly</td>
<td>2–10</td>
<td>n/a</td>
</tr>
<tr>
<td>Post Office</td>
<td>Weekly</td>
<td>2</td>
<td>Percentage of households and households without access to a car within 15 and 30 min of a GP by public transport (30 and 60 min of a hospital)</td>
</tr>
<tr>
<td>Medical trip or visit</td>
<td>Monthly</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>


Table 2. Benchmarking of older people’s (minimum) travel needs
confirmed in studies of older people (King et al., 2003), in which parks, restaurants and church/faith centres also ranked as frequent destinations. However, government accessibility indicators did not include food shopping. Busy (traffic, pedestrians, shops, signage, etc.) centres may also be a turn-off to some older people (and adults with young children), particularly the frail, dementia sufferers and those lacking confidence and mobility. The review by Cunningham and Michael (2004) of studies in this field also found that the most consistently significant factors were safety and aesthetics, and to a lesser extent, urban design (e.g. pavements, lighting). There is, however, a relationship between safety, aesthetics and the design and the layout of the environment and routes, and how they are perceived and used.

The recommended approach from this review is the use of objective measures in combination with user evidence to ‘provide a richer more accurate picture of environmental influences on physical activity’ (Cunningham and Michael, 2004: p. 442), and one that therefore should involve the community in order to ensure that their perspectives are considered.

In order to identify design-related barriers, the quality of the physical environment must be thoroughly analysed. An urban design street audit (street design index (SDI)) has therefore been developed to include aspects that contribute to accessibility, and which could then be used for modelling and developing a geographical information system (GIS)-based tool for urban design and accessibility analysis. This is outlined here in terms of the research methodology, reconciling the difficulties in street auditing for urban design and accessibility interaction, and illustrating the features and attributes that have been selected.

The data collection method within a test bed area is then described along with the data analysis and design improvements arising. This approach can be seen to continue on from Appleyard’s seminal work on ‘livable streets’ pioneered in 1960s San Francisco (Appleyard, 1981). Appleyard studied three similar streets with varying levels of road traffic, observing the significant variation in residents’ social networks and interaction, street life and general well-being, with heavy traffic acting as a territorial divide between neighbourhoods. His methods of observation and annotative image mapping using tracing paper and capturing residents’/users’ perceptions were the precursors to the ‘planning for real’ and now GIS-participation techniques, and to the various simulation techniques used in inclusive design and urban modelling today.

It should be noted that the approach presented here focuses on the pedestrian and walking environment. It is acknowledged that as part of wider mobility and safety efforts, cycling has been the subject of design and behavioural intervention, with provision of cycle lanes, interchanges and traffic calming and separation measures, allied to employer incentives away from car use/parking and towards cycle and pedestrian/public transport use. This has included some novel mobility cycling aids for the physically disabled, for example as promoted by the ‘inclusive cycling forum’ (although, here, confusion over what constitutes an ‘invalid vehicle’ and barriers to adapted bikes/trikes have limited their effect). It is also worth noting that, nationally, cycling to work has not increased over the past decade although particular cities and zones (e.g. congestion charge areas of London) have seen dramatic increases. At the same time, cycle accidents and theft have challenged the targets for increased commuter cycling. In the author’s street audit and design project, on-street cycle parking facilities and cycle theft are important factors in any integrated design solution to accessibility, and in this respect this is another example of ‘shared space’ requiring the pedestrian to be placed at the top of the hierarchy of need.

4. Street design index for the inclusive journey environment

The aim has been to develop a transferable index for accessibility (Azmin-Fouladi, 2007). Three key areas of guidance, good practice and standards were synthesised: physical/transport accessibility, safety/design against crime, and urban design quality (CABE, 2001). In creating the SDI, drawing on the extensive literature (Evans, 2009), criteria were selected that can be measured and that can also provide a set of defining attributes, rather than generalised descriptions which are not helpful in detailed design specification. Where such definitions, as in the case of intangible factors, were absent, based on observations and in consultation with other researchers, they were defined more concretely.

The auditing itself was conducted in two stages. Firstly the macro-elements, as outlined in Table 3, and secondly detailed categories were considered and conceptualised (Table 4). As is emphasised in Better Places to Live (CABE, 2001), the individual elements of buildings, landscapes and their interface have a key role in determining the overall quality of an area. However, auditing all these elements for a wide area is time consuming and impractical. Thus after identifying sections of public spaces and routes within the selected test bed areas (London and Hertfordshire) which exhibit negative qualities, micro-elements such as design of railings, treatment of boundaries and appearance of shop fronts were examined thoroughly. Some of the features considered to be most influential include

- design and arrangement of boundary walls/railings/plantings
- planting (trees, planters, grassed areas, flowers and borders)
- banners and signs (interpretative, instructive, informative and directional)
- lighting (pavement, pedestrian, highway, security, building and feature)
- public art and features (permanent and temporary works, fountains and graphics)
Land-use – office, residential, commercial, occupation/usage, temporal, mixed use
Windows
Active frontage
Walls/boundaries
Setbacks
Public space – graffiti, vandalism, fly-tipping, litter and other problems
Street furniture – seats, bins, bollards, tree grilles, railings, signposts

■ shop fronts (thresholds, glazing, stall risers, signs, banners and shutters)
■ advertisements (hoardings, kiosks and banners, signage)
■ safety and security (emergency equipment, CCTV, gates and grilles)

Over 20 indicators representing the prime macro-elements were identified and assessed (Table 5). These elements were

<table>
<thead>
<tr>
<th>Concepts/aspects</th>
<th>Elements/variables/cases/values</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Natural surveillance</strong></td>
<td>Both sides (numbers)</td>
<td>Lots of windows, some windows, no windows, no ground-floor windows</td>
</tr>
<tr>
<td>Windows (eye on the street)</td>
<td>One side (numbers)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No windows/blank walls/bushes and green areas</td>
<td></td>
</tr>
<tr>
<td>Activities on the footway</td>
<td>Shops, places of business (frontage)</td>
<td>Curtilage – narrow &lt; 1.5 m, absolute 1.5 m, accepted 1.8 m, desired 2 m</td>
</tr>
<tr>
<td></td>
<td>Gathering places (benches/children’s play area)</td>
<td>Public park, as part of walking environment; communal, front garden</td>
</tr>
<tr>
<td></td>
<td>Street market (occasional activities)</td>
<td></td>
</tr>
<tr>
<td><strong>General image</strong></td>
<td>Graffiti/vandalism</td>
<td></td>
</tr>
<tr>
<td>Broken windows</td>
<td>Boarded-up buildings/broken windows</td>
<td>Front garden, parking cartilage, access to lower ground, planter &gt; 10 m wide</td>
</tr>
<tr>
<td></td>
<td>Rubbish/general cleanliness</td>
<td>&lt; 1.5 m, &gt; 1.5 m</td>
</tr>
<tr>
<td><strong>Territoriality</strong></td>
<td>Setbacks</td>
<td>&lt; 1.5 m, &gt; 1.5 m height</td>
</tr>
<tr>
<td></td>
<td>Demarcation of public/semi-public/private</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enclosure/continuous building frontage, proper height: width ratio</td>
<td></td>
</tr>
<tr>
<td><strong>Fear-based route configuration</strong></td>
<td>Entrapment (width of the footway)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blocked prospect/open sightline</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bushes and grown-up plantations</td>
<td>&lt; 1.5 m, &gt; 1.5 m (bushy), planter</td>
</tr>
<tr>
<td><strong>Special features</strong></td>
<td>Local characteristics/identity</td>
<td>Listed building, conservation area</td>
</tr>
<tr>
<td>Landmarks and historical buildings/features</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical barriers</strong></td>
<td>Accessibility to buildings</td>
<td>Level entry, ramp, step, steps</td>
</tr>
<tr>
<td></td>
<td>Accessibility to buildings</td>
<td>Change of surface, change of level</td>
</tr>
<tr>
<td></td>
<td>Level entry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ramp</td>
<td></td>
</tr>
<tr>
<td>Step(s)</td>
<td></td>
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</tbody>
</table>

Table 3. Macro-elements of urban design audit

Table 4. Categorisation of urban design micro-elements for street design audit
captured in an observational audit and mapping of test bed sites – the Somerstown and Elm Village neighbourhoods in the London Borough of Camden (St Pancras Ward) – which had been the subject of traffic calming (similar to home zone pilots, Biddulph (2008)) and crime prevention interventions.

The above elements were recorded onto a hard copy ordnance survey (OS) map (1:500 scale), and subsequently transferred into GIS digital map format, creating a rich database resource for spatial analysis and visualisation, and subsequent consultation (Figure 2). Contextual data were also collected for the area, and visualised in two- and three-dimensional formats, including land use, building heights, recorded crime (property, street/vehicle crime), Ordnance Survey’s POI, such as amenities, retail, and transport, as well as socio-economic and demographic profiles drawn from the census, indices of multiple deprivation and Experian demographic, lifestyle data (e.g. car use, travel to work). By using a wide range of available data, this baseline mapping can be undertaken for other areas at various scales of geography, and in a comparative framework. In the present SDI case, spatial data have also provided the baseline for street audit and resident surveys and a reference for the findings from user surveys, in which variations between primary and secondary data often arise around local perceptions and experience regarding safety on particular routes/journeys, as well as social and amenity factors.

Primary data collected from this test bed area were geo-coded into a GIS database and mapped. In order to analyse the quality of the public realm for the inclusive journey environment, attributes of each element were ranked with negative and positive values (Table 5). For example, areas/routes that have a low level of natural surveillance are drawn based on the combination of the following six variables: no window; no ground floor window; blank walls; high fences; boundary wall/plantation; and setbacks of up to 50 m; and setbacks of 100 m (Figure 3). By using the GIS modelling technique combined with photos, spatial and observational data were layered to determine key routes and areas with potential personal security/fear of crime problems (Figure 3).

This same approach has been applied to the quality of urban design within the area, where elements that contribute to a negative environment can include a lack of ‘enclosure’ (inadequate relation between building height and street width), abnormal setbacks and ‘dead frontage’ (Azmin-Fouladi, 2005). By overlaying negative features, a new layer is created. These
Figure 2. Urban design factors – GIS database

Figure 3. (a) Permeability and ease to movement to local transport and amenities; (b) problematic routes to local transport and amenities
and other aspects can be further analysed by examining micro-elements where specific problems are identified, and where barriers are expressed by participants in user (resident and first-time visitor) surveys. The accessible street audit approach has also been adopted early on by the regional transport authority in their Guidance to Local Authorities for Submission of Local Accessibility Schemes (TfL, 2007: pp. 8–9).

5. GIS-participation community mapping

Following the comprehensive street audits and digital data analysis, leading to the creation of the SDI, small focus group meetings and postal questionnaire surveys were also conducted with residents, and accompanied map walks were organised with participants as an experiential exercise to consult on their perceptions of street features and routes. The use of questionnaires in residential neighbourhoods produced a more representative sample and comparative data, aided by the support of a residents/tenants association and publicity in the estate newsletter. This also afforded analysis by household type, tenure and formation, location, age, gender, and so on. Limitations to pedestrian access and more frequent journeys included ‘fear of crime’ and ‘road safety’ as prime barriers, as well as problems with walking surfaces and amenities, with specific problem features and areas annotated on maps. These participant comments were overlaid with problematic streets, routes and features delineated from the prior street audit, which showed close correlation, but also divergence (Figure 4).

Focus groups were also held with the use of large-scale maps, through the GIS-participation (GIS-P) technique (Cinderby et al., 2006). Here participants – young children and parents, residents, workers – were able to annotate these using text and colour-coded stickers on the local area map, to mark their home and journey routes, problem areas and amenities, and intermediate features such as bus stops and facilities such as public toilets and benches. Fear of crime was also the barrier that was ranked by far the highest by residents, followed by road safety, pavements and distance to amenities (Figure 1). The walk to the bus was the most problematic. A growing concern was the effect of new housing development on adjoining infill/brownfield sites, which reduced pedestrian access (routes closed or made longer/unsafe) and also reduced views and sight lines. Major alterations to the streetscape present particular problems to older people and dementia sufferers for whom familiarity and landmarks are important for confidence in undertaking regular journeys (Mitchell, 2007).

Participant consultation conducted with focus groups and individuals, using both face-to-face and self-completed questionnaires and annotated maps completed after guided map walks, included older people, as well as young men, women, single parents/mothers with toddlers. The results have been used to refine the journey design assessment and GIS-based street visualisations in an iterative design process, and practical design recommendations have been made. The feature attributes in particular were validated with end-users (residents groups, visitors), and with professionals with responsibility for the urban, street and transport environments, through a questionnaire with explanatory images from the test bed area. These rated the various factors using a five-point scale to determine both their inclusion as key barriers in the pedestrian environment and mobility, and their relative importance. This validation and weighting can be re-applied in each test bed and user group situation to reflect local conditions, subjectivities and preferences. This is more flexible than fixed design metrics and standards, in which ‘one size does not fit all’. The annotated maps were analysed, together with focus group and questionnaire surveys, and mapped data digitised in GIS (Figure 4). These were then integrated with spatial data on demographic, land-use, facility/amenity (e.g. bus stops, public toilets), and recorded crime data for the area, producing a synthesis between the primary, qualitative information and spatial data. For instance, areas of high street crime density were overlaid with participant’s own experience and perspective of safe(r) and unsafe areas. These revealed convergence, but also divergence, between those areas in which recorded crime was concentrated and where street audits revealed problematic routes and areas – and other areas where particular groups felt safe, unsafe or ‘feared’ crime (and anti-social behaviour).

Some reported factors were functional and physical such as narrow streets, dangerous crossings (islands too small for wheel/push chairs), lighting and poor surveillance, whereas others were social such as noise and pubs/alcohol (e.g. for Muslim young men). Fear of crime also depended on prior incidents (including those reported in the local media), reputation (e.g. gangs) and other local community knowledge. This highlights the importance of not relying solely on street/environmental design, movement and crime analysis without participant input and observation. In this sense, space is socially produced, with local knowledge and practice influencing travel behaviour and choice, which may vary across different user groups at different times of the day.

6. Conclusion

The case study and visualisations presented here draw together street design, digital data analysis, participant observation and qualitative methods, but owing to brevity represent a small proportion of the spatial analysis and features which can be captured through this set of techniques (Evans, 2009) – these are available online at (AUNT-SUE, 2014). In particular, the coding of features, routes, areas, densities is best viewed in colour on screen/printed maps and three-dimensional visualisations. The availability of spatial digital data, online maps and user-friendly design and visualisation software – allied to GIS systems now widely used in local government and transport planning and in urban design and masterplanning – makes this
proposition more feasible. The mapping and profiling of communities and data on crime (e.g. snatch theft, robbery, cycle theft, etc.) and road accidents can be used as the precursor for selecting street areas in which to undertake a detailed SDI study. This can also respond to particular community concerns at residential or ward level, and target areas with high proportions of, say, older or mobility-impaired residents, or schools or where particular barriers to access are identified. Areas undergoing new development schemes including transport interchanges can also benefit from this approach, as has been found with new station extensions and approaches in both city centre and suburban locations.

Digitising annotated maps and correlating these with spatial data for feedback in an iterative design process can also be used for assessing street improvements as well as interventions such as extended transport routes and bus stop location and interchange. Actionable findings and take-up by boroughs (street design, urban design, accessible transport) and transport agencies/operators have encompassed micro-street maintenance.

Figure 4. Synthesis of street design audit with participant focus groups and map walks
and accessibility guidance (TfL, 2007), station access and more strategic transport and land-use planning using this inclusive design approach. This complements and informs borough plans and community strategy exercises, as well as local transport plans which form the basis of funding of transport improvement, thereby demonstrating greater social inclusion and access in this process. This model has also been adopted in Canadian ‘age-friendly community’ urban design and transport planning at city and provincial levels. Research findings and urban design tools have also been included in successive parliamentary annual reports Research and Development Work Relating to Assistive Technology (DoH, 2008; DoH, 2010), and in advice to the Cabinet Office Strategy Unit’s An Analysis of Urban Transport (Cabinet Office Strategy Unit, 2009). The SDI in its comprehensive application can be used standalone and as an addition to the accessibility and street design guidance noted here, such as Link and Place and Accession, in providing a more accurate and representative accessible journey environment that better reflects pedestrian experience and barriers to mobility.

The triangulation of comprehensive mapped digital data, with observational and systematic street design analysis, combined with user consultation on needs, aspirations and perceptions, is an ambitious process. But it is the author’s belief that this is a required approach given the complexities that the urban environment presents. One that moves beyond, but also draws upon, the physical access audit, street and place design toolkits and consumer survey regimes, that are currently used in QoL assessments and performance indicators, and in accessibility benchmarks. The whole journey environment and chain may seem a fraught governance scenario, given the range of interests and disciplines responsible for individual elements. However, local authorities, the police and transport agencies have the key role and powers in linking the pedestrian, road and urban environment with the transport system; likewise the central government ministries which hold responsibilities for planning, transport and safety.

The urban design approach outlined here, which provides a menu of spatial factors and visualisations layered to produce combinations of linear and cluster analysis in both two- and three-dimensions, thus offers a powerful tool which can be used in community consultation and planning; urban design/place-making and scenario-building; and in creating an interactive spatial database as a resource for the wide range of users and decision-makers in the urban environment and transport fields.

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