Inclusive Design for Getting Outdoors

Researching how the design of streets and neighbourhoods can make a difference to older people's wellbeing and quality of life.

Tactile paving design, siting and laying

I'DGO

THE UNIVERSITY OF SALFORD

There is growing evidence that well-designed outdoor spaces can enhance the long-term health and wellbeing of those who use them regularly.

At I'DGO (Inclusive Design for Getting Outdoors), our aim is to examine what this means for older people. When we think about ***lifelong*** access to and enjoyment of neighbourhood environments, we place older people at the heart of the sustainability and regeneration agendas. But is this reflected in current policy? And does the latest 'best practice' in the design of outdoor spaces really meet the needs of all users?

Findings to date

The first phase of I'DGO, which involved over 770 people aged 65+, demonstrated the importance of outdoor environments in people's lives.

Those we talked to said they went out into their local neighbourhood very frequently, most often on foot (regardless of season). The main reasons they gave were to socialise, exercise, get fresh air and experience nature. We found that environments that make it easy and enjoyable to go out can have a crucial influence on older people's activity levels, general health and overall satisfaction with life.

As part of our study, we did a physical audit of 200 residential neighbourhoods and found that a typical street contains a number of barriers to getting around as a pedestrian. These environmental features often compound personal limitations and social circumstances, as well as fears about crime and heavy traffic. We looked at them in tandem with the preferences of 200 older people, who told us what detailed design features they see as being beneficial to getting outdoors.

Collectively, the research gave rise to a suite of guidance documents, including ***The Design of Streets with Older People in Mind.***

The Design of Streets with Older People in Mind is a toolkit of 12 parts, each relating to a specific environmental feature of street design. Aimed at local authorities and designers, it is set within the context of UK policy and guidance, including the Department for Transport's *Manual for Streets* (2007) and the Scottish Government's *Designing Streets* (2010).

The toolkit is particularly helpful to designers of footways and footpaths, addressing factors such as width, adjacent and shared use, materials and changes in level. The fifth section details three key kerb types: plain/normal; plain/dropped; and tactile/dropped.

Recommendations and case studies are also included on seven further attributes of the urban realm: pedestrian crossings; signage; bus stops and shelters; seating; street art; street greenery; and public toilets. To download the guidance in full, visit **www.idgo.ac.uk/design_guidance**

What we are looking at now

Progress on the next phase of research – I'DGO TOO – is well underway, supported by the Engineering and Physical Sciences Research Council.

This involves the work of four leading research centres: the Edinburgh-based OPENspace; SURFACE and the Centre for Health, Sport and Rehabilitation Sciences Research at the University of Salford; and the WISE (Wellbeing in Sustainable Environments) research unit at the University of Warwick.

Collectively, we are placing a critical focus on the way in which sustainable design policies and practice influence 'everyday' outdoor environments for older people: an area where evidence is currently lacking. We know from the first phase of I'DGO what the *likely* benefits will be but also where certain design features may actually create problems, especially if badly maintained. Our ultimate aim is to influence age-friendly, sustainable design approaches at a range of scales, from the places in and around people's homes to local neighbourhoods and wider urban environments. >>

>> One of the key areas in which current best practice may present both benefits and barriers to older people is in the design, siting, laying and use of tactile paving. This widely used system (based on textured ground surfaces) provides guidance for blind and visually impaired people at critical warning points on streets (such as pedestrian crossings). It is designed and laid in accordance with Department for Transport UK guidance and British Standards 7997:2003 and 7533:2003. Its use is supported by empirical research involving visually impaired people, people with a range of other impairments and non-disabled people.

The benefits of tactile paving for blind and visually impaired people have been well established yet the system is not without its issues. Two in particular emerge from a 2005 report by the Health and Safety Executive, which suggests that there is a need to better understand the extent and implications of incorrectly designed and laid tactile paving and the toe clearance of an individual in negotiating paving 'blisters' and potential slip hazards.

I don't feel safe, I feel I might trip and they hurt my feet…they are fine providing they are in the right place and at the right angle but so often they are not. If they are sloping and wet they are dangerous and look horrible.

These factors seem to us to be crucial to older people, since many of our first phase interviewees expressed concerns about falling or feeling unstable on tactile surfaces and fall-related injuries are associated with loss of independence, morbidity and death in older people. Therefore we have dedicated a core part of I'DGO TOO – the element undertaken by the University of Salford – to investigate the potential impact of tactile paving on older adults' mobility and quality of life.

Our study is ground-breaking in that it combines 'real world' and laboratory-based research and involves the coming together of experts in both the built environment and biomechanics (the study of how forces impact on the living body). We believe that this integrated research approach is the most effective way of ensuring that our work considers all factors which influence falling and that our findings will have optimum practical application.

Why I'DGO matters to me

Getting outdoors is vital to the health of all older people, including those living with dementia. Out of doors can be a real treatment for dementia symptoms like sundowning and sleep-wake disturbances. One of the major challenges we face today as a society is to mainstream this group of people rather than keeping them inside and out of sight—something not good for either them or us. The multi-method approach of I'DGO provides real hope that we will be able to eventually reach this goal.

Dr John Zeisel PhD, President & Co-founder, Hearthstone Alzheimer Care (USA)

What do we want to know?

Our research on tactile paving has the following objectives:

1. To examine how blister and corduroy tactile paving is designed, sited and laid;

2. To identify older people's perceptions and approach to negotiating tactile paving;

3. To quantify the relationship between tactile paving (when laid according to guidelines), the biomechanics of walking and risk of falling.

The outcome will allow for a better understanding of the complex trade-offs made by designers, suppliers and clients of tactile paving systems.

Why I'DGO matters to me

I came to I'DGO with ten years experience as a prize-winning architect, urban planner and academic. Having studied in my native Bangladesh and the University of Hong Kong, I wanted to develop my research skills in an entirely different cultural landscape. The people-focused aspect of I'DGO greatly appealed to me, both in terms of the emphasis on 'real world' participants and the close-knit nature of the team. Doing the fieldwork – come rain, snow or shine – hasn't always been easy, but it's filled me with confidence that what we are doing really matters.

Mohammad Faruk BArch MSc

What we are doing in the 'real world'

Our 'real world' research involves 48 pedestrian crossing sites and 18 step sites throughout the UK.

The majority of these sites have tactile paving, either blister or corduroy, though some have none. They have been chosen for their diversity, using criteria at a range of scales, from the broad-brush to the very detailed. Such criteria include: regulations and guidance; type of settlement; and topography.

The majority of the crossing sites (40) are controlled, that is, they are either zebra, pelican, puffin, toucan or signalised. Eight crossing sites are uncontrolled.

The step sites provide for a range of external environments and even internal spaces, such as railway stations.

To assist with our fieldwork and ensure consistency across the project, we have developed two tactile paving toolkits: one for crossing sites; and one for step sites. Each incorporates a user questionnaire and establishes a protocol for observation-led research.

For each crossing and set of steps we have...

- provided a map of the site and the context in which the paving has been laid
- undertaken on-site observations of the routes taken in using the crossing or steps: noting potential hazards and/or enabling features; and measuring environmental factors (including slip resistance using innovative methodology) that may influence pedestrian safety
- undertaken on-site observations of people using the crossing or steps and interviewed a select number of pedestrians at each site >>

- >> distributed a user questionnaire to people using the crossing or steps, querying factors such as: their preference for surface materials; the effectiveness of tactile paving as a warning; their use of crossings and/or steps: the environmental hazards they face; their health and history of falls (anticipated return of c. 1,650 questionnaires overall: 950 crossing sites; 700 step sites)
- interviewed the local authority highways departments responsible for the implementation, maintenance and safety of the crossings, including paving (limited to crossing sites and c. 50% complete)
- assessed the extent to which the tactile paving (if applicable) has been designed and laid in accordance with guidance
- planned a focus group of 16 participants aged 65+ with a range of health issues and mobility / vision impairments for liaison at the next research stage

Our preliminary analysis of the data collected for both the road crossing points and step sites suggests that there is wide variability in the design, siting and laying of blister and corduroy paving. There is also considerable deviation from the design guidance, primarily because of variability of context. It seems likely that the maintenance of the paving may have a critical effect on pedestrian safety, though further work is required to substantiate this expectation.

Our work also extends to an international comparison study of three crossing sites in New Zealand and two step sites in Australia. Taking in the cities of Christchurch, Wellington and Sydney, this study allows us to explore alternatives to the UK scenario, such as the use of truncated dome blisters as a hazard warning and lozenge tactile paving as an aid to wayfinding. A common feature of the non-UK sites is the considerable emphasis placed on colour contrast between tactile paving and surrounding surfaces.

The toolkit for the international element of our fieldwork is tailored to the Australasian context. This has allowed us to undertake similar mapping, on-site observation, assessment and questionnaire-led exercises to those we have completed in the UK within the parameters of different national standards and guidance.

When we've assessed how tactile paving has been designed and laid, for example, we have done so in respect to the NZ Transport Agency's *Pedestrian Planning and Design Guide* (2007) and *RTS 14* (2007) and *Australian Standard AS 1428* (2003). We have also interviewed policy and user representatives from the Royal New Zealand Foundation of the Blind, the Editor and Senior Pedestrian Movement Engineer for the NZ Transport Agency and the Chief Pedestrian Planner for City Streets in Christchurch City Council.

The anticipated return from our user questionnaires is 250 across all five sites and we have completed three focus groups with 25 variously impaired people aged 65+. Data collection and input are complete, while analysis is underway.

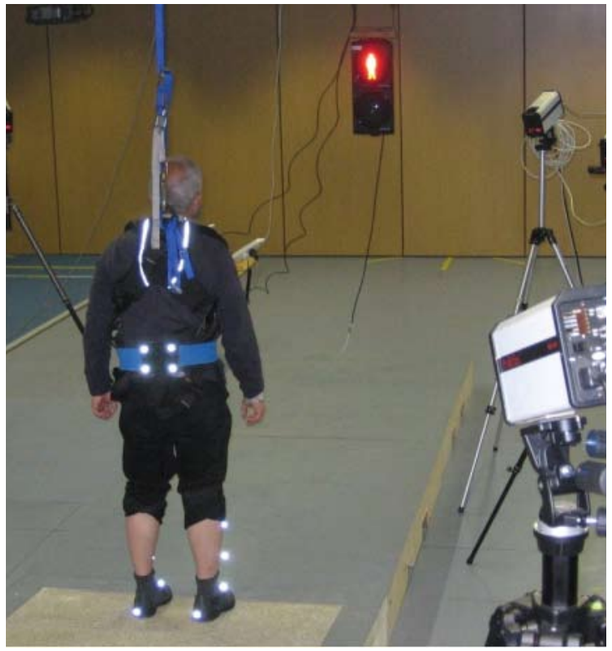
Jenny MacLennan at a blister tactile paving step site in Sydney

What happens in our laboratory?

The work we undertake in our laboratory focuses on the relationship between tactile paving (when laid according to the Department for Transport UK guidelines), the biomechanics of walking and the fear and risk of falling.

For this element of our study, we have developed a nine metre long walkway that functions, under laboratory conditions, as a controlled pedestrian crossing. The walkway is made up of moveable sections that can be slotted together (using a palette truck) to create differently paved types of footway (tactile or smooth), each with three flat and one ramped section. The configurable nature of the system (which comprises six sections in total) means that smooth, tactile and combination scenarios can all be tested within one session.

The photograph below shows the test rig in use, with a safety-harnessed participant responding to a 'red man' crossing light at the opposite side of the simulated street. In this instance, the walkway is configured to include two sections of red blister tactile paving – one flat and one ramped – as well as smooth, flat sections at each end.



By this stage, the participant has crossed an invisible infrared light beam at the start of the ramp, which triggered the crossing light to change. Data on his gait is now being collected using optoelectronic cameras that track the position of reflective markers mounted on his shoes and waistband. He has come to a successful stop before the kerb and is waiting for the 'green man' (controlled by the researcher) to appear before crossing the simulated street.

Our laboratory protocol

We've designed the experiment so that we can see how each of our participants walks on both smooth and tactile paving and subsequently compare their two gaits.

Before the experiment begins, we gather background data on our participants' age, mobility, medical history, past incidents of falling and living circumstances. We then allocate them, randomly, into one of two groups. Group A begin with walking trials on tactile paving, followed by trials on smooth paving; Group B proceed through the study in the reverse order.

Following the group stage – and in a randomised order – participants then walk at self-selected speed along the test platform a total of 30 times. Both paving types are used – smooth and tactile – and three conditions investigated: continuous walking (in which the participant proceeds along the platform uninterrupted); walking with an early traffic light trigger (where the participant's leg crosses a light beam located 1.2 m before the start of the street section, thus triggering the 'red man'); and walking with a late traffic light trigger (where the light beam is located 0.8 m before the start of the street section).
Finally, during periods of quiet standing on both tactile and smooth paving slabs, sway kinematics are monitored in relation to both the flat and ramped sections of the walkway.

Andrew Bonehill (above), Matthew Major and Dr Sibylle Thies (right) brief older participants in the laboratory

How we analyse the data

The laboratory data gathered by way of the body-mounted reflective markers is labelled using standard commercial software (Qualisys) and filtered and processed using customized MATLAB® algorithms.

This allows us to calculate the factors associated with the risk or fear of falling, including: step width; step length; step time variability; and comfortable gait speed. Based on heel strike, the stance and swing phase of each foot can be determined and toe-off events identified from the position data of the corresponding foot markers.

This subsequently allows for the calculation of step parameters during dual support (e.g. step width and length) and single support (e.g. toe clearance), as well as step time.

We have also been able to collect data on each participant's ability to come to a halt without stepping onto the street for the two conditions that incorporate traffic light triggers. Our preliminary analysis of the data collected to date suggests that there may well be an observable difference in gait between paving surfaces. However, further work is required to substantiate this finding.

While 32 healthy older participants have used the laboratory to date, further participants are yet to be tested. In tandem, we are developing our data analysis software to allow for a more informative interpretation of movement data.

The I'DGO TOO tactile paving study is being undertaken by the SURFACE Inclusive Design Research Centre and the Centre for Health, Sport and Rehabilitation Sciences Research at the University of Salford.

Our team comprises: Professor Dave Howard; Dr Laurence Kenney; Hamish MacLennan; Mohammad Faruk; Professor Chris Nester; Rita Newton; Professor Marcus Ormerod; and Dr Sibylle Thies... with support from Andrew Bonehill, Matthew Major and Jenny MacLennan.

We are grateful to an international team of professionals from both academia and commercial industry, including our three external advisors:

Dr James A Ashton-Miller of the Institute of Gerontology at the University of Michigan (USA); Professor Hylton B Menz of LaTrobe University (Australia); and Dr John Zeisel of Hearthstone Alzheimer Care (USA). Thanks also to Age Concern England, the Department for Communities and Local Government, English Heritage, the Health and Safety Executive, Building Research Establishment, JMU Access Partnership and Marshalls Paving.

Our experimental walkway was fabricated by the Centre for Sustainable Technologies and Regeneration (STaR) at the University of Salford.

Hamish MacLennan interviewing a participant at a crossing site in Manchester

About us

I'DGO is built around a core group of international academics in three leading research centres: the Edinburgh-based OPENspace; SURFACE at Salford; and the WISE (Wellbeing in Sustainable Environments) research unit at the University of Warwick.

We are funded by the Engineering and Physical Sciences Research Council and play an active role in its flagship knowledge transfer consortium, KT-EQUAL (www.equal.ac.uk).

Our focus is on identifying the most effective ways of shaping outdoor environments inclusively. We support the needs and preferences of older people and disabled people, always seeking to improve their independence and overall quality of life.

Our multi-disciplinary consortium is a virtual centre of excellence, involving a wide range of partners engaged in older people's issues. We use innovative research tools and 'joined-up' quantitative/qualitative methods.

We are committed to maximising the accessibility of our research; our findings have already had a significant impact on the decision makers and designers who influence our built and natural environments.

For further information on the I'DGO TOO tactile paving study, please contact:
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