I'DGO TOO: INCLUSIVE DESIGN FOR GETTING OUTDOORS
Mid-term report on I'DGO research consortium progress, June 2009

SUMMARY OF REPORT – KEY ISSUES AND PROGRESS TO DATE

Aims and Objectives: I'DGO 1 identified the key components of the outdoor environment that make a difference to older people's lives; it identified the environmental barriers that people face in getting about outdoors, and some of the mechanisms behind associations between outdoor activities, experience, wellbeing and quality of life (QoL). This led us, in our second phase project, I'DGO TOO, to place a critical focus on the way in which current sustainable design policies and practice influence outdoor environments that older people (65 years +) experience on a daily basis. We know from I'DGO 1 what the likely benefits of sustainable design will be for older people but, in addition, there are key areas where such design may create problems for outdoor experience and QoL. We are currently targeting these areas to establish:

a) empirical evidence to confirm where current policies and practice offer benefits and/or create barriers and disbenefits;
b) triangulation for demonstrating relationships between environment and activity, as objectively measured, with self-reported behaviour, perceptions, and QoL as experienced by diverse older people, living in a range of contexts;
c) better methodologies and tools for testing the effectiveness of design interventions for sustainable urban environments as they relate to older people's QoL;
d) support for general principles that may in future guide more age-friendly sustainable design approaches across scales, whether in and around people's homes or in the wider neighbourhood and urban environment.

The I'DGO TOO projects involve work at three different levels of detail, to research:

1. the implications of high-density urban housing on residential outdoor space, such as gardens and balconies;
2. pedestrian-friendly and shared space approaches (such as Home Zones) in residential street environments;
3. the practical consequences of using tactile paving (designed to assist people with visual impairment) for older people in the urban environment.

Progress to date includes:

- establishment of the relevant knowledge base and gaps in research and understanding;
- engagement with stakeholders at all levels in developing the research and opportunities for dissemination and knowledge exchange;
- identification of key issues, elements and variables to be researched and development of innovative methods (quantitative and qualitative) to gather data;
- identification of survey sites and participants;
- initiation of data gathering - this is in progress at present;
- ongoing development of methods for data analysis.

Ongoing data collection includes:

- cross-sectional postal survey of 4,000 older people on their residential outdoor environments and in-depth 'walk-along' interviews and diary keeping with 50 older people;
- longitudinal (before-and-after) interview surveys of 100 older people, and recordings of accelerometer and diary data from them, across eight sites where there are plans to change residential streets into shared space environments;
- cross-sectional questionnaire surveys of 2040 older people in relation to tactile paving at pedestrian road crossings and steps on 72 sites, including comparators from Australia/New Zealand;
- laboratory testing of walking stability for older people on tactile paving;
- a range of independent measures and audits of people's outdoor environments on sites around Britain relating to the three different focuses of I'DGO TOO projects

Dissemination and knowledge exchange. A truly sustainable urban environment is one that offers equity of access to healthy environments – ones that support wellbeing and quality of life. I'DGO TOO offers an important critique of current sustainability policy in the light of older people's experience. By examining key aspects of outdoor space around people's homes, in their local street and on footways that lead to the wider urban environment, we will be able to provide better, evidence-based guidance for sustainable design in future. Working with over 30 partners, with international experts and with the KT-EQUAL knowledge exchange consortium, we will ensure that our methods and guidance are fit for purpose, have an impact on policy and practice, and address national and global concerns. Government Departments such as Communities and Local Government (CLG) are already citing our research, as are officers of the World Health Organisation's Global Age-Friendly Cities programme.

BACKGROUND AND I'DGO TOO AIMS

The I'DGO (Inclusive Design for Getting Outdoors) consortium was launched in 2004 to investigate how outdoor environments affect older people's quality of life (QoL) and to identify what aspects of design help or hinder older people in using the outdoors. It was funded by the Engineering and Physical Sciences Research Council (EPSRC) under round 4 of the EQUAL initiative (Extending Quality Life for older and disabled people). User-friendly summaries of research findings and design guidance based on the first phase of I'DGO projects (completed in early 2007), together with lists of publications, are available on the I'DGO website at www.idgo.ac.uk.

A new phase of I'DGO projects has been initiated through EPSRC's EQUAL 5. These projects - under the umbrella title of I'DGO TOO - focus on particular policies and strategies currently being promoted by government as part of the sustainability agenda - urban renaissance, integrated communities and inclusive environments - where the potentially important, practical implications for older people's lives have not fully been explored and tested. It asks: how well do outdoor environments, built or regenerated in line with such policy, contribute to older people's QoL? It involves work at three different levels of detail, as outlined below.

I'DGO TOO projects commenced between January and June 2007 and runs until June 2011. This mid-term report constitutes a record of progress for the first two years of the projects.

1. THE IMPLICATIONS OF HIGH DENSITY URBAN HOUSING FOR RESIDENTIAL OUTDOOR SPACE

Work by the Oxford Institute for Sustainable Development, Wellbeing in Sustainable Environments research unit (OISD:WISE), Oxford Brookes University.

The aims of this part of the research are to use a cross-sectional study:

- To determine the pluses and minuses of urban renaissance developments, in terms of residential outdoor space and quality of life of older residents.
- To determine how, and to what extent, different types of residential outdoor spaces (private gardens, shared gardens, balconies, courtyards etc.) contribute to the quality of life of older people.
- To identify how best to design different types of residential, outdoor spaces in urban renaissance housing to deliver maximum benefits to older people.

1.1 Establishing the existing knowledge base

An extensive review of literature confirmed the paucity of research in this field. Residents' homes and gardens are often cited as their 'favourite places' (Korpela et al, 2001). Residential outdoor space (ROS) such as gardens also form an important part of the UK's urban environment, accounting for around 20-25% of urban areas (where data exist) (RCEP. 2007). The nature of ROS is changing with evidence showing that up to 47% of front gardens in the north-east of England are currently more than three quarters paved (RCEP, 2007). There is no research examining the implications that different types of ROS, be they paved or green, may have on residents' wellbeing, or at different residential densities. As policy has shifted to a focus on higher-density housing development, the implications that this has for the provision of ROS is not yet fully understood. For example, while it is claimed in policy that the provision of high-density housing promotes social interaction among

residents, this is not supported by empirical evidence (Bramley et al, 2009). Furthermore, the impact that the type and nature of the resulting ROS (e.g. balcony, shared outdoor space or public outdoor space where housing development is mixed-use) has on wellbeing is as yet not understood.

1.2 Identifying key aspects of ROS and wellbeing

Policy and guidance documents were reviewed to identify the features of ROS claimed to be important for older people's wellbeing. From literature and discussions with our research partners and members of our international expert panel we identified the following aspects of ROS as likely to have a bearing on wellbeing:

a. The **type** of ROS (e.g. shared garden, private garden, parking space, storage space, balcony)
b. The **amount** of ROS (i.e. total area of different types)
c. The **form** or **layout** of ROS (e.g. shape, orientation of ROS, whether spaces are front or back)
d. The **detailed design** of ROS (e.g. type of planting, whether hard landscaped or soft, whether trees or shrubs or flowers)
e. The nature of ROS **boundaries** (e.g. fences, walls, hedges)
f. The nature of the **thresholds** between the home and ROS (e.g. whether direct access or from stairwell or communal hallway, access via front or back door or patio/French doors)
g. The **views** of ROS from inside the home

After reviewing standardised measures of wellbeing, we focused on aspects of wellbeing likely to be influenced by ROS. From the review of literature and discussions with partners and experts we identified a range of relevant aspects of wellbeing.

1.3 Development of the questionnaire on ROS and wellbeing

We developed a detailed questionnaire to survey older people's current experience in relation to these aspects of wellbeing and ROS. We are undertaking a cross sectional survey with a target total sample of 4,000 respondents, to be followed up by a smaller number of in-depth 'walk-along' interviews (around 50) and diary keeping. The questionnaire was developed and extensively tested through piloting initial drafts. The questionnaire seeks to obtain information on:

a) Respondents' current ROS

The type and form of ROS respondents currently have access to
Satisfaction with their ROS; what is positive and negative about their ROS
How the ROS is used in the warmer and colder months
Whether they are able to carry out desired activities in their ROS, how easy it is to access and how it affects them (mood, privacy etc.)
Perceived barriers to use of ROS

b) Respondents' IDEAL ROS

What it would comprise and what purposes it would serve

c) Views from the home

The importance of views for respondents and satisfaction with their views
The character of current views from the home vs. the character of respondents' IDEAL views

d) Respondents' wellbeing

Satisfaction with their home; perceived community spirit; perceived level of independence
Enjoyment of life; self-rated health; impairments; self-rated quality of life

e) Personal and household information

Type/tenure of home; living accommodation floor level
Length of residence; size of household; number of children in household or who visit
Gender, age; socio-economic status; ethnicity

Respondents are also asked to indicate if they would be willing to participate further in the research through an interview.

1.4 Identification of survey sample

The aim is to obtain a representative sample of older people to reflect the natural diversity of older people in the UK, In addition to sampling from age-specific housing, e.g. retirement and sheltered housing, we also want to sample older people living in 'ordinary', non age-specific housing. Therefore, the questionnaire was designed to be suitable for completion by residents of all age

groups as it was not possible to determine which addresses belonged to people aged 65+. The questionnaires from other age groups will provide data for a parallel study being undertaken by the WISE I'DGO TOO research student, Amanda Griffin.

We are targeting a sample that represents a balanced range in terms of:

- Age and non-age-specific housing
- Social and private housing
- Density of development (to capture so-called 'urban renaissance' housing as well as more traditional lower-density, suburban development)
- Form of development (low-rise to high-rise, courtyard housing to tower blocks etc.)
- Type and amount of ROS (green and hard landscaped, with and without balconies, varying amounts of parking etc.)
- Geographical location (regions and urban/rural neighbourhoods within these)

As the survey is being administered by post, from which a response rate of around 20-25% can be expected, 16,000 addresses were needed to achieve the target of 4,000 returned surveys. We are aiming for roughly equal numbers of responses from the following five main categories:

1. age-specific private housing (i.e. sheltered)
2. age-specific social housing (i.e. sheltered)
3. non age-specific private housing (i.e. not sheltered) - post-1999 (i.e. urban renaissance)
4. non age-specific social housing (i.e. not sheltered) - post-1999 (i.e. urban renaissance)
5. general 'other' housing - pre 1999 (i.e. not urban renaissance)

Identifying these 16,000 addresses was a considerable task, requiring the close involvement of our research partners: Places for People, English Courtyards and Peabody Trust. We focused initially on using partners' developments, then extended to other developments. The website www.Housingcare.org, which is led by the charity Elderly Accommodation Counsel (EAC), was used to search for age-specific/sheltered accommodation. Google Earth and Ordnance Survey Digimap were used to examine the characteristics of each development in order to keep a record of the number of addresses within each of the categories listed above.

1.5 Survey administration

Questionnaires are now being sent to all the addresses identified above, through a phased operation. So far, around 8,000 have been sent out. Response rates so far are as follows:

Housing type	Response rate to date
Age-specific private housing	23%
Non age-specific private housing	18%
Age-specific social housing	10%
Non age-specific social housing	15%
General 'other' housing	x% (no questionnaires sent to this sample yet)

1.6 Pilot study

As a pilot study, 549 questionnaires were sent to residents of mixed tenure tenement buildings in Dalry, Edinburgh, with a 17% response rate. Of the 93 respondents, 68% ranked sitting and relaxing as one of the four most important purposes of their outdoor space, 47% included an attractive environment in their top four, 41% cited space to hang out washing and 38% space for visitors. This suggests that outdoor space contributes to QoL and wellbeing through physical, aesthetic, practical and social means. Lack of privacy, poor maintenance and unattractiveness were the most common reasons for not using their outdoor space which suggests that good design and maintenance of outdoor space could contribute to QoL. These are only preliminary findings.

1.7 Walk-along interviews

Following analysis of the postal survey questionnaire, 50 respondents will take part in walk-along interviews in their own homes to investigate in greater depth their needs and preferences in terms of their residential outdoor space. Interviewees will also be asked to take photographs and to sketch features of actual and desired outdoor space and to use diaries over a one-week period to record their use and feelings while in the outdoor space.

1.8 WISE I'DGO TOO Research Student's PhD study

The research student, Amanda Griffin, is also conducting a separate research study to achieve a PhD. The main aim of her research is to examine how the design and management of shared, private outdoor spaces influences the roles that these spaces play in the lives of residents of higher density housing. Her sample includes residents of all ages. Data are being collected from the I'DGO TOO ROS questionnaires returned by respondents between the ages of 18 and 64 and in-depth interviews will be conducted to investigate the role that shared, private ROS plays in people's lives. Maps and plans will be used to aid participants in recording perceptions of key features of ROS. Following data analysis a workshop will be held to present findings to participants and to receive their feedback.

1.9 Working with partners

Partners have particularly assisted in the selection of housing developments to include in the research sample. Partners include the Peabody Trust, The Orders of St John Care Trust, the Homes and Communities Agency (HCA, formerly Housing Corporation), English Courtyard Developments, RIBA, PRP Architects, Elwood Landscape Design, Steve Ongeri (independent consultant) and the newly recruited Places for People.

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The Oxford Brookes research team comprises Professor Elizabeth Burton, Lynne Mitchell, Dr Nicola Dempsey and Amanda Griffin.

2. ARE HOME ZONES A GOOD SOLUTION FOR AN AGEING POPULATION?

Work by OPENspace, the research centre for inclusive access to outdoor environments, Edinburgh College of Art, in collaboration with Heriot-Watt University and University of Edinburgh.

This project is a longitudinal study – the first of its kind – that examines whether shared space street projects such as Home Zones are a good solution for an ageing population, using a before-and-after design.

Our main question is: Does implementation of shared space projects such as Home Zones result in environments where older people:

- Go outside more often?
- Spend more time outside in the local environment?
- Have better social networks?
- Have a better quality of life?

2.1 Background to the project

Recent research has demonstrated significant relationships between environmental quality and various wellbeing measures for older people, including physical activity (Joseph and Zimring, 2007; Sugiyama and Ward Thompson, 2007), mental health (Lampinen et al, 2006), social cohesion (Kearney, 2006; Kim & Kaplan, 2004) and overall health (Mitchell and Popham, 2008). However, the causal links and mechanisms behind these relationships have not been demonstrated adequately in research to date. Longitudinal studies are needed to test the effects of changes in neighbourhood environments on people's activity patterns and thereby on lifestyles, health and quality of life (QoL). Such longitudinal studies, are extremely difficult to undertake in real world contexts and there is, in general, a lack of systematic evaluations of environmental interventions. This is the challenge being addressed in the current project, using a current policy initiative – Home Zones and similar shared space schemes – as the environmental intervention.

Home zones (originating in the Netherlands as 'woornerf') are residential streets where people and vehicles share the whole of the road space safely, and on equal terms, and where quality of life takes precedence over ease of traffic movement. The objective is to extend the benefits of slow traffic speeds within residential areas to give priority to non-motorised users and encourage them to use streets in different ways (DfT, 2005)

2.2 Developing the research methods

A number of research methods are being used to assess the residential street environment and older people's outdoor activity in their local area subjectively, according to older people's perceptions and experience, and objectively, using independent measures. These measures involve an interview using a questionnaire, use of an activity monitor (accelerometer) and a self-complete activity diary, street audits and behavioural observations.

a) Interview questionnaire. The interview questionnaire includes several sections:

i. Personal projects involving outdoor activities - people are asked to rate their personal projects according to type of activity, location, and how important and enjoyable it is.
ii. Perceptions of the environment – this relates to outdoor spaces around the home, local streets, and the neighbourhood in general.
iii. Satisfaction with life and health status – previously validated scales are used in this section, to explore a range of health and quality of life questions.
iv. Frequency of going outdoors – this asks how often respondents go outdoors in typical summer and winter months
v. Personal information on age, living arrangement, socio-economic status, etc..

b) Activity measures and diary. Participants are asked to wear an accelerometer for 7 days, during their normal waking hours. It counts the number of steps and measures the level of activity taken during different time periods. Different types of pedometer were used during initial pilot studies but it was ultimately decided that an accelerometer should be used as this gives a more accurate record of the activity times and levels of the wearer.

An activity diary has been developed to be used in conjunction with the accelerometers. Participants are asked to complete the diary for the full week, to record their outdoor activities and social contact made when outdoors.

c) Street audit. A street audit tool for independently recording the characteristics of the local street environment has been modified from one developed earlier by the OPENspace team (Millington et al, 2009) to measure the 'walkabiity' of urban streets as part of the Scottish Physical Activity Research Collaboration (SPARColl). A checklist of elements from street trees to building types and paving surfaces is used.

d) Behaviour observations. A protocol for systematic behaviour observations (Gehl (1987) has been developed to allow independent recording of people's activity, regardless of age, in the streets under survey. This allows for objective measures of activities and levels of social contact to be recorded. Pilot studies were carried out during October and November, 2007 in Manchester, Glasgow and Edinburgh..

2.3 Choice of sites

Sites were identified with the help of partners. Ideally, these have been sites where a Home Zone type of intervention is proposed to be implemented in 2009, allowing time for surveys to be carried out both before and after the environmental works are carried out. Sustrans assisted with this by identifying a number of 'DIY Streets' sites across England and Wales that satisfied these requirements. In addition, we have been attempting to identify sites in Scotland. Because of a lack of retro-fit Home Zone schemes in Scotland, where environmental improvements are made in existing residential streets, we have used an alternative approach, where we invite participants currently living in conventional residential streets but about to move into new-build homes in developments designed according to Home Zone principles.

In almost all cases, our sites are in areas of high multiple deprivation, since it is these areas which attract funding environmental improvements and redevelopments. Thus our sample consists principally of older people living in contexts of disadvantage.

2.4 Identification of survey sample

We have attempted to contact every person aged 65 and older in each of the study streets chosen, to invite them to participate. Through local contacts and facilitators, we used a variety of approaches, including residents' associations, community meetings, explanatory leaflets, etc., prior to inviting individuals to participate.

Figure 1 shows a typical survey street – a residential area of two-storey terraced housing before implementation of 'DIY Street' environmental changes	**Figure 2:** shows computer-based behaviour observations tools – a tablet for use in the field with GIS maps onto which people's locations and movements can be recorded

2.5 Survey sample to date

Data has so far been collected from 8 shared space project sites (Sustrans 'DIY Streets' and Edinburgh Home Zone) plus matching control sites in relation to all the research instruments presented before. In addition, a reliability check has also been undertaken for the street audit tool. 100 interviews have been carried out and nearly 50 participants have agreed to wear an accelerometer and keep a diary for a week. In addition we have undertaken 27 street audits and 208 behaviour observations and parked vehicle counts to date.

2.6 Data analysis and findings to date

After cleaning and preparing the different data sets, we are now in the process of analysing the baseline data and present a few examples to illustrate the patterns emerging so far.

From early examination of the interview questionnaires, the following patterns have emerged:

- Being outdoors, whether alone or for social purposes seemed to be important for many participants.
- Participants seem to vary considerably in terms of their activity levels. Age does not appear to be related to the level and type of activity. For example, some participants who are 85+ engaged in active outdoor pursuits such as gardening, whilst many participants who were younger did not exhibit the same activity levels.

The behavioural observation data show different patterns depending on the time of day. For example, more people were alone in morning observations (67%) than in the afternoons (52%), while 37% talked to another person in the afternoons, compared with 24% in the mornings. The percentage walking or using a wheelchair, as opposed to other activities such as running, cycling or sitting, was almost identical in the mornings and afternoons at 71 to 74%.

The data from the activity monitor helps us to understand patterns of activity and their distribution in the day and on different days of the week (see figure 3). It also shows the intensity of activity and duration of activity bouts. Accelerometry, used in conjunction with activity diary data, gives precise timing, duration and intensity of activities reported, distinguishing their type (walking or other daily activities) and allowing better classification into their levels (i.e. light, medium or intense activity).

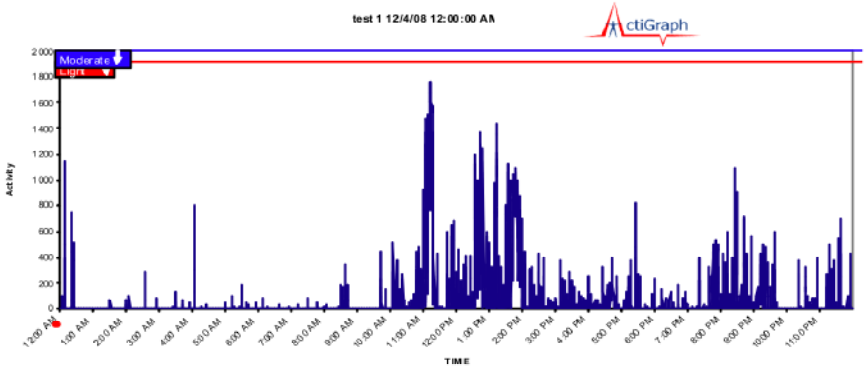

Figure 3: shows a typical day's physical activity by one participant, recorded with activity monitors, showing major peaks and periods of activity at 11 am, between 1 and 2 pm and between 8 and 10 pm

2.7 Working with partners

OPENspace's 20 research partners include: Help the Aged, Guide Dogs for the Blind, DfT, Scottish Government, NHS Health Scotland, CABE Space, Greenspace Scotland, Swindon Borough Council, Sustrans, TRANSform Scotland, Living Streets, the Institute of Highway Engineers (IHIE), the Central Council for Physical Recreation (CCPR), Jacobs Babtie, Phil Jones Associates, Peter Brett Associates, EDAW, Mayer Brown Ltd and Ian Wall (independent consultant). Partners have been invited to separate research progress meetings and have assisted with refinement of the research instruments, identification of survey sites and making contact with older people in survey sites.

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The OPENspace research team comprises Professors Catharine Ward Thompson, Peter Aspinall and Archie Young, Drs Susana Alves, Catherine Millington and Affonso Zuin, with the assistance of Petros Andreadis, Flis Callow, Jaya Ghosh and Julia Markovich.

3. THE EFFECTS OF TACTILE PAVING ON OLDER PEDESTRIANS – A REAL WORLD AND LABORATORY INVESTIGATION

Work by SURFACE Inclusive Design Research Centre and the Centre for Rehabilitation and Human Performance Research, University of Salford

The I'DGO TOO tactile paving study investigates the potential impact of tactile paving, in particular when poorly designed and laid, on biomechanical measures associated with falls, through a cross-sectional study with the following research 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 using tactile paving;
3. To quantify the relationship between tactile paving design parameters and the biomechanics of ambulation and risk of falling.

The outcome of the study will allow for a better understanding of the complex trade-offs that are implicitly made by designers and installers of this kind of paving.

3.1 Background to the tactile paving research project

Tactile paving has been developed in order to provide warning and guidance for blind and visually impaired people and is used at critical warning points such as pedestrian crossings. It is designed and laid in accordance with design guidance from the DfT (1998) and from BS 7997:2003 and BS 7533:2003. The empirical research supporting this guidance is based on a sample of 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 (DfT, 2005).

However a recent report by the Health and Safety Executive (Loo-Morrey, 2005) suggests that there is a need to better understand both the extent and implications of incorrectly designed and laid tactile paving and toe clearance of an individual in negotiating blisters on paving and potential slip hazards. Importantly, older people interviewed for the IDGO 1 project have expressed their concerns about fear of falling, instability, and difficulty in negotiating tactile paving. Comments included:

> "Really uncomfortable"
> "Feel as if you are going to twist your ankle on it"
> "I prefer to walk around them"
> "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 right angle but so often they are not, if they are sloping and wet they are dangerous and look horrible, they are a waste of time. I don't know any older person who likes them".

Fall-related injuries in older people are associated with loss of independence (Dunn et al, 1992) morbidity (Gryfe et al. 1977) and death (Sattin, 1992). In particular, activities such as stair climbing and walking on uneven ground (tactile paving may be considered a type of uneven ground) have been reported in conjunction with falls (Berg et al, 1997). A number of biomechanical variables (e.g. speed, step variability measures) have been associated with both falls and fear of falling (Hausdorff et al, 2001).

3.2 Real world research approach and progress

a) 49 **pedestrian crossing sites** have been selected throughout the UK. The sites were selected on the basis of macroscopic and microscopic criteria developed using a range of influences such as regulations and guidance, type of settlement, topography, etc.. 41 sites are at controlled crossings (zebra, pelican, puffin, toucan and signalised junction) and 8 sites are at uncontrolled crossings. 47 sites have tactile paving, a tactile paving audit toolkit for crossings, a user questionnaire and an observation protocol have been developed to assist with the crossings fieldwork. Since users are identified through a diverse range of site types and locations, participants will reflect a diverse sample of older people. For each crossing we have:

- Assessed the extent to which the tactile paving slabs (if applicable) have been designed in accordance with the guidance and laid accordingly;
- Provided a map of the context in which the paving is laid;
- Measured environmental factors that may influence a person's safety;
- Undertaken on-site observations of potential enablers and hazards on the routes that pedestrians take in using the crossing;
- Undertaken on-site observations of people using the crossing, including interviewing a small number of pedestrians for each crossing;
- Distributed a user questionnaire to people using the crossing, asking them about their preference for footway materials, effectiveness of tactile paving as a warning, use, environmental hazards, their health and history of falls (anticipated return of about 1200 questionnaires);
- Interviewed the local authority highways departments responsible for the implementation, maintenance and safety of the crossings including paving (about 50% complete)
- Proposed to convene a focus group of 16 participants aged 65+ with a range of health issues and mobility / vision impairments when we have an initial set of research findings (not yet complete).

Preliminary analysis of the data collected to date suggests that there is wide variability in the design, siting and laying of blister paving at road crossing points and that there is considerable deviation from the design guidance, due primarily to the context in which the crossing is sited. It is also likely that maintenance of paving may be a critical issue. However, further work is required to substantiate these findings and to determine the effect of this on a pedestrian's safety when crossing the road.

Images from case study pedestrian crossing sites

Figure 4 shows Hamish MacLennan, I'DGO researcher interviewing an older person about his experience of using	**Figure 5** shows poorly laid and maintained buff coloured blister paving at an uncontrolled drop	**Figure 6** shows correctly laid and well maintained red coloured blister paving at a controlled

tactile paving at a crossing in Manchester	kerb crossing in Balerno, Scotland	crossing in Huntly Street, Inverness.
		

b) 18 **sites with steps** have been selected throughout the UK using similar macroscopic and microscopic selection criteria to the crossings. The selected sites provide for a range of internal (railway station) and external environments, and provision of tactile paving (corduroy, blister and no tactile paving). We have developed toolkits and, for each set of steps, used similar measures to those for crossings.

Data collection for the steps fieldwork is largely complete, with an anticipated return of about 540 questionnaires; data inputting and analysis has yet to be undertaken.

Images from case study step sites

Figure 7 shows Hamish MacLennan, I'DGO researcher taking measurements for the tactile paving toolkit at one of the case study step sites in Manchester	**Figure 8** shows corduroy tactile paving sited at the bottom of internal railway station steps in Sheffield demonstrating good tonal contrast with the surrounding paving and good colour contrast on the stair nosings	**Figure 9** shows corduroy tactile paving at the top of a flight of external steps in Edinburgh, with poor tonal contrast with the surrounding paving
		

c) **International comparison** - an exploratory study of 3 crossing sites in New Zealand (Christchurch and Wellington) and 2 step sites in Australia (Sydney) is being undertaken. Truncated dome blister tactile paving is used in areas of hazard warning such as crossings and steps, unlike the UK, and corduroy tactile paving is not used for steps. Lozenge tactile paving is used for wayfinding. Considerable emphasis is placed on colour contrast between the tactile paving and the surrounding

paving material. For each site we have used similar measures to those for the UK context, with variations in the following items:

- Assessed the extent to which the blister paving have been designed in accordance with the guidance and laid accordingly (NZ Pedestrian Planning Guide 2007, RTS 14 Land Transport NZ, Australian Standard AS 1428) ;
- Interviewed policy / user representatives from the NZ Foundation for the Blind, the Editor and Senior Pedestrian Movement Engineer for Land Transport NZ, and the Chief Pedestrian Planner for City Streets in Christchurch City Council;
- Completed a focus group of 16 participants aged 65+ with a range of health issues and mobility / vision impairments.

Data collection from the international study is complete, with a return of about 170 questionnaire and a focus group held with 16 participants aged 65+ with a range of health issues and mobility / vision impairments. Data inputting and analysis has yet to be undertaken.

3.3 Laboratory research approach and progress

a) Developing the experimental walkway. The primary goal of the laboratory study is to quantify the relationship between tactile paving design and the biomechanics of ambulation and risk of falling. In order to examine this relationship an experimental walkway representing a controlled pedestrian crossing has been designed and built. The assembled walkway consists of a flat wooden approach section, followed by a further flat paved section (tactile or smooth paving), a paved ramped section (tactile or smooth paving) and finally a flat wooden section, representing the road. Figure 10 shows the test rig assembled for testing of tactile pavement on biomechanical parameters associated with fall risk and fear of falling. A participant-triggered pedestrian crossing light is located at the end of the walkway. Each participant is protected from falling through a safety harness system (Solostep Inc.). Data are collected on the participant's gait using a commercial optoelectronic motion capture system (Qualysis AB) that tracks the position of a series of body-mounted reflective markers.

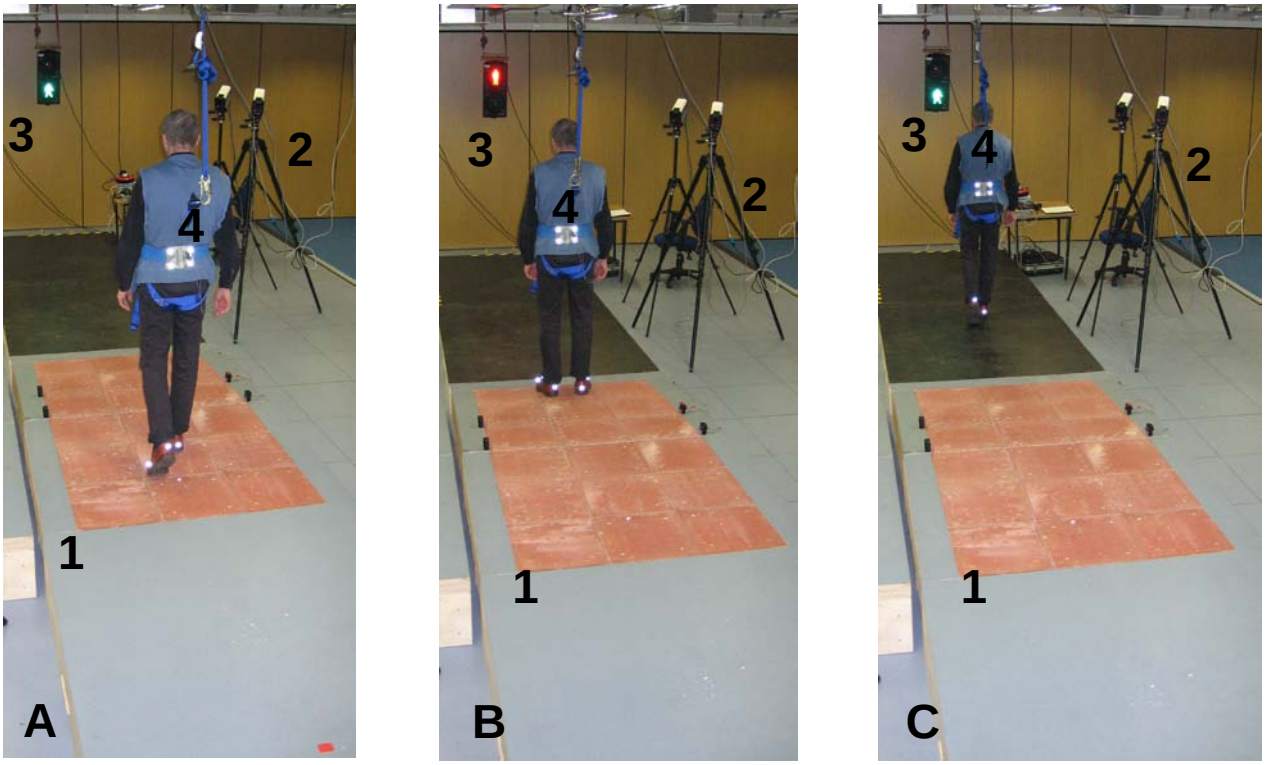

Figure 10 (previous page): Laboratory test rig. Shown are 1) the tactile paving configuration of the test rig, 2) optoelectronic cameras surrounding the rig, 3) the pedestrian light at the end of the rig, and 4) a participant connected to the overhead harness system and with reflective markers on the body. The participant started walking on level, smooth ground, then continued on the level red blister pavement (A) and further onto the ramp with red blister paving (B). At the start of the ramp the participant's foot crossed an infrared light beam which triggered the pedestrian light to turn red. In this trial the participant came to a successful stop before the kerb. Next, the researcher turned the light back to green for the participant to begin crossing the black street section (C). Camera data of the participants' movements allow for determination of biomechanical parameters associated with fall risk and fear of falling.

b) The experimental protocol was designed to allow for a within-participant comparison of gait on tactile paving with gait on smooth paving. Prior to commencing the walking trials, descriptive data on the participants' age, mobility, medical history, past incidents of falling and living situation are collected. Participants are randomly allocated into either group A or B. 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. Participants then carry out, in a randomised order, a series of walks at self-selected speed along the walkway for both paving types. A total of 30 walking trials in a randomised order are completed by each participant. Three conditions are investigated; i) continuous walking, in which the participant proceeds along the walkway uninterrupted; ii) walking with an early trigger of the traffic light, i.e. the participant's leg crossing a light beam located 1.2 m before the start of the street section triggers the light to switch to red and; iii) walking with late trigger, i.e. the participant's leg crossing a light beam located 0.8 m before the start of the street section triggers the light to switch to red. Finally, sway kinematics are gathered during quiet standing on tactile paving and smooth paving surfaces, for both, the flat and ramp section of the walkway.

c) Data analysis
Preliminary analysis of the laboratory data collected to date suggests that there may be an observable difference in gait between paving surfaces. However, further work is required to substantiate this finding. Testing of participants needs yet to be concluded and software development for data analysis is still undergoing iterations to allow for more informative interpretation of movement data.

3.4 Working with partners

The I'DGO TOO tactile paving study is being undertaken in collaboration with Age Concern England, Department for Communities and Local Government, English Heritage, the Health and Safety Executive, JMU Access Partnership, Marshalls Paving, John Gregory (independent advisor).

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DISSEMINATION AND KNOWLEDGE TRANSFER

The I'DGO website (www.idgo.ac.uk) continues to be a primary means of dissemination for the consortium's work and give details of outputs, activities and events that have allowed exchange of knowledge about I'DGO research. Previous guidance and findings from EQUAL research have been disseminated along with I'DGO phase 1 findings and phase 2 findings as they emerge. The World Health Organisation (WHO) 2007 'Global Age-friendly Cities: a Guide', refers to the I'DGO website and design guidance – one of only two references given for design support.

Other examples of I'DGO research influencing policy include the following. The consortium was invited to contribute to a Ministerial Roundtable on Delivering Lifetime Neighbourhoods and Inclusive Eco-towns, hosted by Baroness Andrews in August 2008. Mitchell (OISD:WISE) presented the concept of Neighbourhoods for Life developed from the WISE EQUAL research at this roundtable, and she was also invited to join a CLG/TCPA (Department for Communities and Local Government and Town and Country Planning Association) panel developing Eco-town Housing and Inclusive Design worksheets. Ward Thompson (OPENspace) has contributed to a Foresight project on Mental Capital and Wellbeing (Interventions in the Physical Environment to Improve Mental Wellbeing in Older People), a policy seminar supported by CLG and Counsel and Care on 'Delivering Lifetime

Homes and Neighbourhoods for an Ageing Population', a 'Fairness in an Ageing Society Policy Forum' for government ministers and agencies, sponsored by the Fabian Society, on 'Living Well in Your Neighbourhood' and a workshop for the National Council on Ageing and Older People, Ireland.

I'DGO research has been disseminated internationally at a range of academic conferences, particularly in Europe and North America. The book co-edited by Ward Thompson, 'Open Space: People Space', with a significant chapter on I'DGO research, won the chartered Landscape Institute's Research Award in 2008.

The new KT EQUAL consortium, launched in 2007, provides enhanced opportunities for knowledge transfer in future, including a showcase of I'DGO work in Bath in May 2009.

I'DGO TOO Partners are engaged with I'DGO's work in multiple ways, from giving policy advice and asking for evidence to inform policy agenda, to identifying case study sites, providing contacts with end users - professionals and older people in general – and disseminating research findings through their own organizations. The full list of partners is available at www.idgo.ac.uk.

I'DGO TOO Expert Advisers

I'DGO TOO expert advisers include leaders in their field from North America, Australia and Europe. They contribute to the quality and rigour of methods being developed and analysis undertaken, as well as contributing to development and critical review of papers for publication.

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