CI/SfB (31.59)

good building guide

Level external thresholds:

reducing moisture penetration and thermal bridging

GBG 47

Charles Stirling

BRE Scotland

Level thresholds, where the internal and external walking surfaces are level, or almost level, are increasingly being specified to give access to the elderly and disabled. Level thresholds present a potential weakness in the weatherproofing resistance of door openings which may let water in. Given the need for a level structural element which extends through the external wall connecting an external ramp or access way to the internal floor there is also a risk of thermal bridging at the threshold. This Good Building Guide describes some of the technical risks associated with the design of level thresholds and some detailing solutions.

A level threshold exists where the external landing of the door threshold or sill and the internal floor finish are level within acceptable limits. The objective of such a design is to make the thresholds of dwellings more accessible to wheelchair users and people with limited mobility (see DETR's *Accessible thresholds in new housing*). However, in creating this level threshold there are risks of water entering the building and of thermal bridging. These risks must be reduced or eliminated in the design or construction of the threshold.

Although the guidance within this *Good Building Guide* is targeted at the moisture and thermal bridging risks that arise, the designer should also be aware of the additional spatial needs of disabled people or those with walking difficulties. Wheelchair users, for example, may be able to traverse individual obstacles at floor level. However, several barriers in quick succession, for example, a large step, threshold bar or a slope may provide sufficient difficulty or barrier to prevent effective entry to a building. Additionally, small steps and threshold bars may be effectively negotiated but the jarring and bumping associated with crossing these may result in pain to some wheelchair users.

Figure 1 A level threshold is where the external walking surface is level with the door threshold and the internal floor finish

This *Good Building Guide* gives advice on designing level thresholds, not only for wheelchair users but also for those with walking difficulties, who may only be able to take small, perhaps shuffling, steps and who would find even small steps and threshold bars extremely difficult. Wheelchair users and individuals with walking difficulties may also

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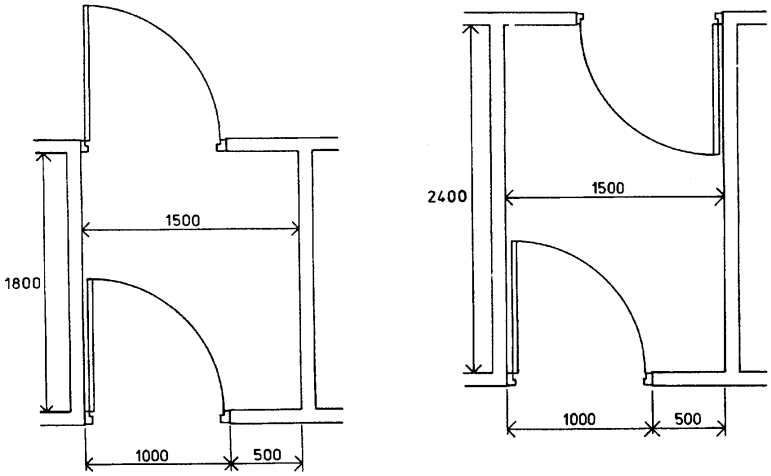
Figure 2 Additional features on the external landing in the form of a porch to give weather protection and railings to give support

find sloping surfaces difficult to negotiate, particularly long, wet or icy ones. In designing the threshold and its approach the designer and specifier need to consider a number of aspects.

Designers should bear in mind that improved access, either at the threshold or in the adjoining external or internal approach areas, also benefits the able-bodied: in particular those having a fuller frame who may find manoeuvring within conventional access areas difficult and inconvenient, and those with small children where the threshold bar and traditional step configuration offer a considerable trip and fall hazard.

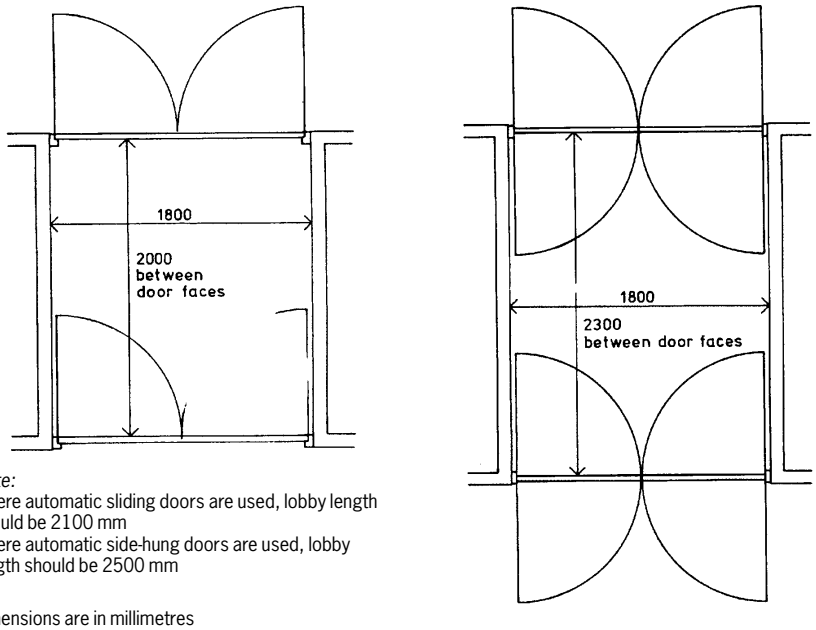
In addition to the guidance relating to the specific design of the threshold and the associated approaches the designer may also wish to consider additional measures which would facilitate access to the building, eg additional covering or weather protection to the doorway (Figure 2). By creating some form of recessed or covered area, for example below a porch or within a lean-to 'garage' area, the design will provide considerable protection to the individuals with walking difficulties or in a wheelchair who may take some time to locate keys, access passes, etc.

Figures 3 and 4 indicate the recommended minimum spatial requirements suitable for the wheelchair user for single- and double-leaf doors.



Dimensions are in millimetres. *NB* Dimensions are taken to structural faces of walls

Figure 3 Recommended minimum dimensions for entrance lobbies, single-leaf doors. Reproduced with permission from British Standard BS 5810



Note:
Where automatic sliding doors are used, lobby length should be 2100 mm
Where automatic side-hung doors are used, lobby length should be 2500 mm

Dimensions are in millimetres

Figure 4 Recommended minimum dimensions for entrance lobbies, double-leaf doors. Reproduced with permission from British Standard BS 5810

The width of the entrance should be a minimum of 800 mm, but ideally it should be at least 900 mm. For double-doors at least one of the leafs should be 900 mm. The entrance should be well lit either naturally or by electrical lighting to ensure safety and to assist the user. The door ironmongery, handles, etc, should provide adequate security but should be easy to use and where time-delayed closers are installed these should allow sufficient time for the user to pass.

The level threshold

DETR's *Accessible thresholds in new housing* has defined the accessible or level threshold as consisting of three principal elements as given below and in Figure 5.

1 The external landing and its drainage
The external landing should be sufficiently large and level for ambulant disabled people and wheelchair users to be able to approach and if necessary turn to face the door. It should be designed to avoid standing water and to limit the amount of surface water reaching the threshold.

2 The threshold, the sill and its junction with the external landing
The combination of sill and threshold profile should allow access for ambulant disabled people and wheelchair users while minimising the risk of surface water entering the building.

3 The internal junction of the threshold with the floor finish
The transition between the lower threshold unit and the internal floor level should accommodate accessible transfer for ambulant disabled people and wheelchair users while permitting occupants the choice of type and thickness of floor covering.

The external landing

The specific size of the external landing ie its width, length of slope, etc. should follow the guidance given in the regulations or approved documentation (see *Further reading*, page 8). The external landing should be laid to a fall between 1 in 40 and 1 in 60 to allow surface water to drain effectively. The fall should be in a single direction away from the doorway. In exposed locations where surface water is likely to be blown towards the door threshold a drainage channel should be provided (Figure 6) which discharges to a drainage system or permeable field drain. In extreme conditions, for example, at the intersection between a ramp sloping towards the door and the external landing, a secondary drainage channel should also be provided (Figure 6).

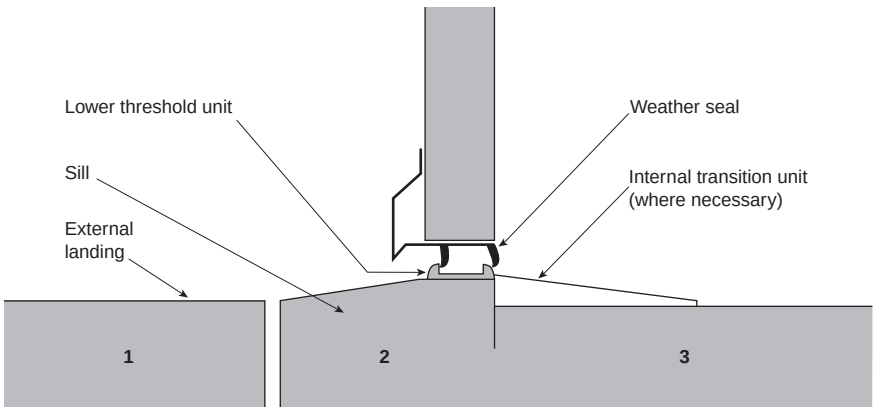


Figure 5 The three principal elements of the level threshold: 1 = external landing and drainage, 2 = threshold, sill and junction with external landing, 3 = internal junction of threshold with floor finish. Adapted from *Accessible thresholds in new housing*

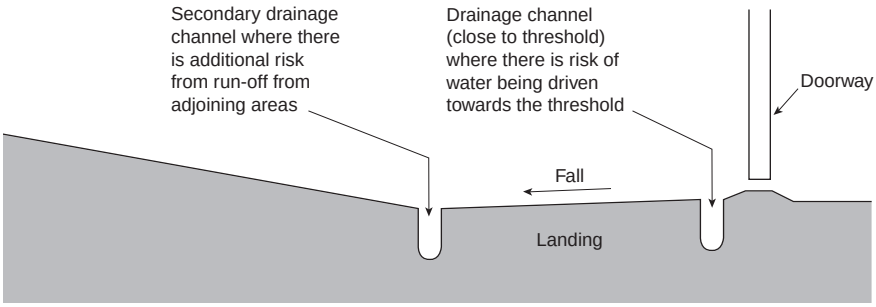


Figure 6 Drainage to external landing. Adapted from *Accessible thresholds in new housing*

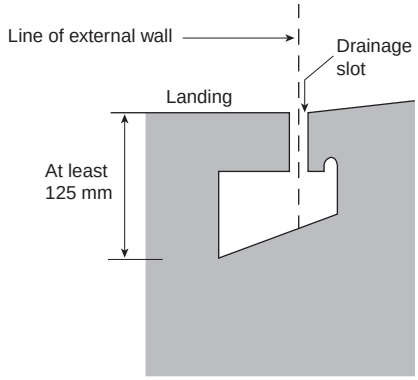


Figure 7 Site-formed discharge channel. Adapted from *Accessible thresholds in new housing*

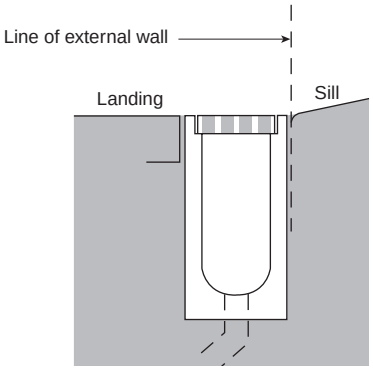


Figure 8 Proprietary discharge channel. Adapted from *Accessible thresholds in new housing*

Figure 9 Typical proprietary drainage channel located on the external landing

This drainage channel can be constructed either as a site-formed slot above a discharge channel (Figure 7) or by a proprietary commercially available drainage channel (Figures 8 and 9). In either case the drainage slots should be no more than 18 mm wide to maximise drainage and to reduce the risk of wheelchair wheels and walking sticks becoming trapped.

The external landing and any associated ramps should be laid in one direction without cross-falls. Cross-falls can make manual wheelchairs drift off course and may make powered wheelchairs skid. The finished surface of the landing and ramp should be laid as a smooth uninterrupted surface. Any anti-slip or skid treatments should be as unobtrusive as possible as some wheelchair users may be sensitive to rough or bumpy surfaces. In addition any undulations in these surface treatments may trap water which can freeze, resulting in an additional slip hazard.

In order to control the surface water around low-lying buildings on steeply sloping sites some additional field drainage may be required, to the adjoining land, to prevent the drainage channels associated with the approach ramp and external landing becoming flooded.

Paths and ramps should have protective edgings, kerbs and, where appropriate, rails to prevent the user becoming stuck in the surrounding ground works. Path edgings also reduce the risk of soil and rainwater wash-down contaminating the path and ramp which may make access difficult and provide an additional slip risk.

In configuring the building floor plan the designer may wish to consider the positioning of sitting rooms or lounges and bedrooms in relation to the access ramps and pathways. Designing access routes into the building and providing privacy for the tenant when using such rooms requires sensitivity. Where it is impracticable to prevent the ramp or pathway from adjoining the building it may be better for kitchens and work areas to overlook these access routes.

Particular consideration should be given to the design and specification of windows that overlook landings and ramps which adjoin the building. Window hoppers and casements which open outwards present a collision risk to foot and wheelchair traffic. Windows in these locations should slide or open towards the inside.

The design and supervision of the construction of any ramps or walkways that adjoin the building requires careful consideration to ensure that there is no added thermal bridging issue resulting from this construction. Particular care needs to be taken where the external wall has or will be externally insulated. When fitting a new ramp to an existing building this external insulation must not be disturbed. In new-build, the external insulation may have to be applied and carried down below ground level (Figure 10) to ensure that the adjoining access works do not constitute a considerable thermal bridge at the ground floor/external wall intersection.

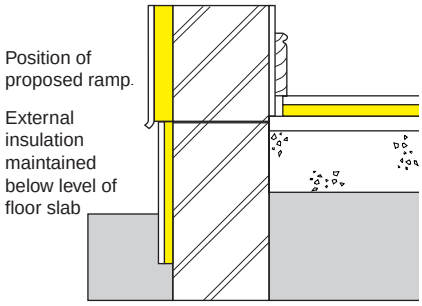


Figure 10 Preventing risk of thermal bridge at adjoining ramps

The threshold and its intersection with the external landing

The threshold to external landing interface must provide the difficult compromise between providing an almost level threshold, free from trip hazards, but maintaining sufficient weatherproofing to reduce the risk of moisture ingress.

Where a site-formed or proprietary drainage channel is located in front on the threshold sill it is preferable to have a completely level landing and threshold. However, where this is impracticable due to exposure to wind driven rain then the landing can be up to 10 mm below the level of the leading edge of the sill (Figure 11). The height of this step should be decreased in reduced exposure locations. Where there is any change in level the leading edge of the sill should be rounded or chamfered to assist the transition for wheelchair users.

Sills leading up to a door threshold should have a maximum slope of 15° to discourage water ingress and to facilitate water run-off. The upper leading edge of the door threshold should be no higher than 15 mm (Figure 11); if it is more than 5 mm, the exposed edge should be rounded or chamfered.

Due to the risk of moisture ingress and the subsequent deterioration of timber components, a drained and ventilated void should be created directly in front of any timber sills or associated components (Figure 12).

In addition to the level threshold, there should be sufficient space provision associated with both the landing, the door itself and the internal lobby. In particular, consideration should be given to providing:

- adequate turning space,
- accessible and, perhaps, larger door handles, associated snibs and keys,
- a shelf for groceries at a convenient level for wheelchair users,
- a sky hole or entrance phone positioned at a convenient level.

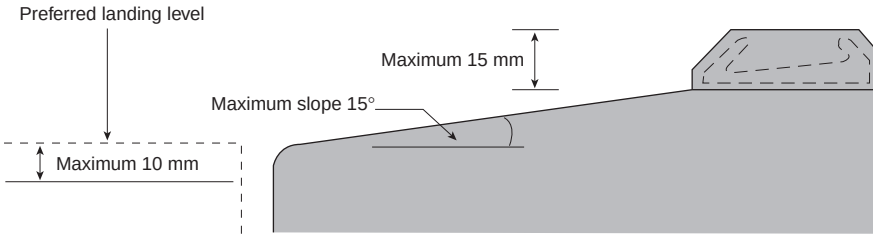


Figure 11 External landing and threshold detail. Adapted from *Accessible thresholds in new housing*

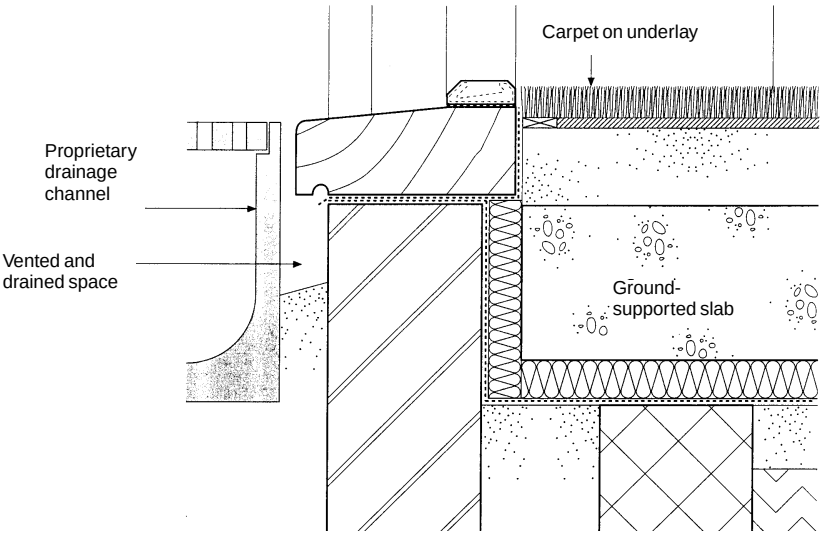


Figure 12 Drained and ventilated space adjoining timber sill. Reproduced from *Accessible thresholds in new housing* by permission of The Stationery Office Ltd

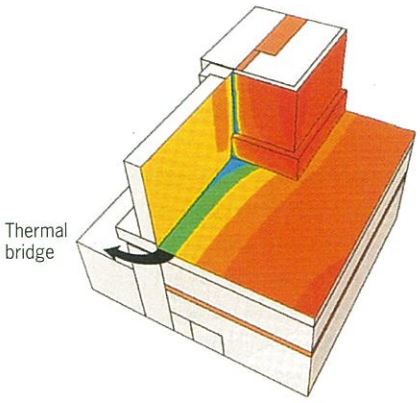
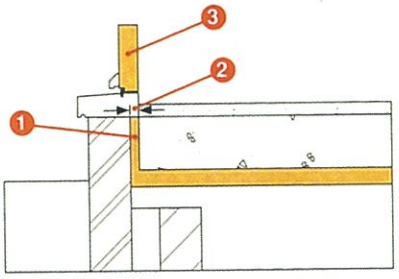


Figure 13 Thermal bridge resulting at typical threshold detail



❶ Insulate edge of slab
❷ Set door frame back to lap edge insulation
❸ Use an insulated door

Figure 14 Insulation carried around ground slab to be continuous with wall insulation

As with external ramps which adjoin the building, door thresholds are an often neglected area of detailing which can be subject to severe thermal bridging as shown in Figure 13. Door thresholds are particularly vulnerable to thermal bridging owing to the lower surface temperatures at the internal corner formed by the threshold or sill. In addition, doors and their frames tend to be relatively thin and poorly insulated compared with other elements of the construction.

In order to substantially reduce the thermal bridging risk at threshold level, the floor insulation should be taken around concrete slabs and suspended timber floors and be continuous with any wall insulation on the underside of the threshold sill. A typical threshold detail associated with an insulated ground-supported floor is shown in Figure 14.

The intersection between the door threshold and internal floor finish

Having successfully detailed the external ramp, landing and door threshold it is important that this philosophy is continued into the internal lobby area. The floor of this internal area should also be level or gradually sloped by means of an internal transition unit in order to make it easier to get indoors.

There is no requirement for a graded platform or internal transition unit where the expected finished floor level is designed to be less than 15 mm below the level of the door threshold unit (Figure 15). This clearance should be reduced to a maximum of 10 mm where the floor covering specified is an uncompressed soft pile carpet. Where a graded transition unit is specified this should have a maximum slope of 15° and have a slip-resistant surface

As highlighted above, the designer must ensure that sufficient space is allowed within this internal lobby area to allow full turning for wheelchair users and unobstructed entry for other disabled users. Careful attention should be given to the provision and positioning of hand rails, storage shelves and control mechanisms.

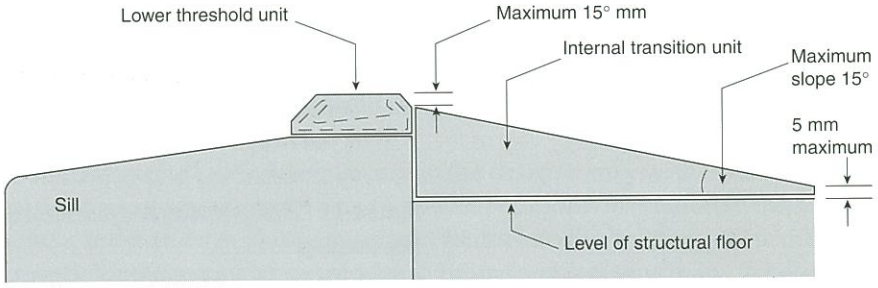


Figure 15 Detail of threshold and internal floor intersection . Adapted from *Accessible thresholds in new housing*

Figure 16 Screw fixings left proud of the threshold unit, as a result of repair, could be a trip hazard

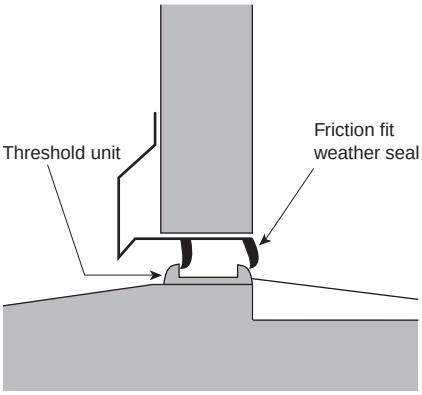


Figure 17 Compression of 'brush type' weather seals. Adapted from *Accessible thresholds in new housing*

Maintenance

In developing the architectural detail and specification the designer should consider future constructional alterations arising from change in occupancy, the occupants' disability or as a result of maintenance requirements. Simply fitting new or replacement components to existing frames or structural elements may not be appropriate when dealing with level threshold details. Where the component parts of the level threshold are required to be replaced the existing components are likely to be completely removed in order that the new component can be effectively fitted to provide the new level threshold detail. The design and construction of level thresholds, therefore, needs to take account of likely future needs. For example, it would be inappropriate if the external landing and internal floor finishes had to be extensively disturbed and refurbished as a result of replacing a door threshold or sill.

Drainage channels which are associated with the level threshold also need to be maintained. Where these are site fabricated and accessed from above simply by a narrow drainage slot then some form of rodding eye or access cover needs to be provided along the length of the drainage run. This needs to be located where it will not impede access to the doorway or provide an additional trip hazard.

The access covers over proprietary drainage channels will need to be removed regularly for maintenance and cleaning. The removal and subsequent refitting of these covers should be designed to be quick, effective and safe. Small grub screws, which may have to be drilled out to allow removal of the cover, can result in a loose-fitting and unsafe cover if these screws are not replaced.

In designing an effective drainage system, the use of field drains rather than direct linking to a mains system may need to be reviewed, particularly in low-lying sites where there may be insufficient storage capacity or run to cope with storm water.

Particular care needs to be taken in the design, specification and routine maintenance of friction-fit weather bars which rely on the deformation of a plastics or brush-type component (Figure 17). Over time these components may become deformed or depressed resulting in the ingress of moisture. The damaged component will have to be replaced and this should be achieved quickly and safely without too much disruption either to the occupant or to the level threshold detail.

Energy Efficiency Best Practice programme (EEBPp)

The UK Government's Energy Efficiency Best Practice programme produces information and guidance on all aspects of energy efficiency. In the building sector, the programme is managed by specialist units at BRE, BRECSU and BREComm. Copies of EEBPp publications referenced in this Guide are available from the Government's **Environment and Energy Helpline 0800 585749**.

BRE Good Building Guides

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The guides draw on BRE site experience and research, and on other reliable sources, to provide clear technical advice and solutions. Every effort is made to ensure that the guidance given is the most authoritative at the date of issue.

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Further reading

BRE

Thermal insulation: avoiding risks. 2nd edition. BR 262. 1994

BRE Building Elements: *Floors and flooring — performance, diagnosis, maintenance, repair and the avoidance of defects*. P Pye & H W Harrison. BR 332. 1997

Domestic automatic doors and windows for use by elderly an disabled people. A guide for specifiers. S L Garvin. BR 334. 1997

BRE housing design handbook: energy and internal layout. BR 253. 1993

Good Building Guides

28 Domestic floors:
- Part 1: construction, insulation and damp proofing
- Part 2: assessing them for replacement or repair — concrete floors, screeds and finishes
- Part 3: assessing them for replacement or repair — timber floors and decks
- Part 4: repairing or replacing floors and flooring — magnesite, tiles, slabs and screeds
- Part 5: repairing or replacing floors and flooring — wood blocks and suspended timber

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Energy Efficiency Best Practice programme — Good Practice Guides

(available from the UK Government's **Environment and Energy Helpline**, see box left)

174 Minimising thermal bridging in new dwellings

183 Minimising thermal bridging when upgrading existing housing

Other publications

Wheelchair housing design guide. S Thorpe. EP 48. Garston, CRC, 1997

Stationery Office

Department of the Environment, Transport and the Regions. *Accessible thresholds in new housing. Guidance for house builders and designers*. 1999

Department of the Environment, Transport and the Regions. *Energy efficiency in new housing: ground floors*. EEO Guide 94. 1995

Department of the Environment, Transport and the Regions. *Ground floor insulation in existing housing*. EEO Guide 9. 1994

Department of Trade and Industry. *The Building Regulations (England and Wales) 1991. Approved Document Part M 1999 edition*

Northern Ireland Office. *The Building Regulations (Northern Ireland) Part R (amended 1998)*

The Scottish Executive. *Scottish Technical Standards Parts Q and S*

British Standards Institution

BS 5810: 1979 Code of practice for access for the disabled to buildings

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