

Guidance Document

G0133

Guidance on Stairways and Ramps

Issue No.: A1

Issue date: March 2014
Review date: March 2019

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1 Purpose

- 1.1 In the London Underground environment, whilst stairs are generally safe, they still represent one of the highest risks within the Premises asset area, to both customers and staff. Poor or inadequate design, construction and maintenance of stairs, and to a lesser degree ramps, can be contributory factors to a risk of falling.

A primary purpose of this document is to ensure that such risk is minimised by providing support to the delivery of project or maintenance works on assets required to comply with the LU Cat 1 standard S1133 Premises – Stairways and Ramps.

- 1.2 Stairways and ramps in the public area are used by large numbers of customers who could be considered to be at greater risk of falls; for example those who have restricted mobility, those who are encumbered with luggage or pushchairs, the elderly, young children, customers who may be rushing, distracted or intoxicated. It is therefore imperative that stairways and ramps are designed, constructed and maintained in such a way as to enable their safe use whilst minimising the potential for incidents.
- 1.3 The Guidance, CIRIA C722 'Safer stairs in public places – assessment of existing stairs' should be referred to and the guidance followed, particularly in the refurbishment of existing stairs.

2 Scope

- 2.1 This Guidance applies to the design and performance requirements for stairways and ramps, including stair flights, landings, nosings, corduroy hazard warning surfaces, ramps and handrails in new or modified assets.

Although there is some reference here to guarding/barriers to stairs and ramps, this Guidance does not provide comprehensive guidance on this aspect of stairways and ramps. For requirements associated with these elements, refer to S1132 Premises – Barriers and Fencing (Non-Lineside) together with the associated Guidance Document G0132 Guidance on Barriers and Fencing.

For the relevant references to be used for stair and ramp finishes, refer to section 3.6.

- 2.2 For the purposes of this Guidance and the associated Standard S1133 Premises – Stairways and Ramps, stairways include:

- a) Public stairways and ramps
- b) Staff stairways and ramps
- c) Escape stairways and ramps
- d) Maintenance stairways - which may be a stair, ladder or ramp.

- 2.3 The dimensions for stairs referred to in this Guidance do not apply to curved or spiral stairways. For guidance on the dimensions of curved or spiral stairs which may only be used to replace the equivalent existing asset, refer to BS 5395-2 Stairs, ladders and walkways. Code of practice for the design of helical and spiral stairs.

3 Guidance

3.1 Definitions and Abbreviations

3.1.1 The following terms are used in this document:

Flight – series of steps between adjacent landings.

Going – the dimension from the front of the nosing on one tread to the front of the nosing on the next tread.

Handrail – component that provides guidance and support at hand level.

HDLT – Heavy Duty London Transport. HDLT pattern stair nosing is the cast nosing traditionally used on LU public stairs.

Ladder – a fixed means of sloping or vertical access, using horizontal rungs, which has a pitch greater than 70°.

Landing – platform or part of a floor structure at the end of a flight or ramp or to give access to a lift.

Nosing – front edge of tread or landing. Applied nosings are a material added to the leading edge of a tread to provide visual contrast to the step and/or to protect the tread material from wear.

Pedestrian guarding – any element of building or structure intended to prevent persons falling over an edge or to control the direction of flow.

Ramp – construction that provides a continuous slope from one level to another.

Riser – vertical or near vertical face of step.

Step – part of a stair that consists of a horizontal surface (tread) and a vertical surface or space (riser) that results from the change of level.

Tread – the horizontal part of a step. The tread is the part of the step on which the foot is placed.

3.1.2 There are a number of references to visual contrast in this guidance. Visual contrast is assessed by measuring the difference in Light Reflectance Value (LRV) between two surfaces or elements. On stairways and ramps these are:

- a) Nosings and the adjacent tread;
- b) Nosings and the adjacent riser;
- c) Handrails and the adjacent wall or background;
- d) Treads and the adjacent walls;
- e) Ramp surface and the adjacent walls and landings.

For further explanation and information on how to measure visual contrast, refer to BS 8300. See especially Annex B.

3.2 Stair and Ramp Design

3.2.1 In accordance with BS 5395-1, the most important contributor to stair safety in the design of public stairs is the dimension of goings. Going dimensions in new stairs shall therefore be a minimum of 300mm wide. This minimum dimension limits the possibility of large oversteps being taken and consequent potential falls. A minimum 300mm wide going also enables use by customers with a wide range of ability to use steps.

- 3.2.2 The design rise (ie. the rise on a design drawing) for every tread should be consistent for every step in consecutive steps and in consecutive flights between floors. BS 5395-1 identifies that the rise for steps should be within the range 150mm to 180mm. It is not acceptable for a top or bottom riser to taper along its length in order to meet a sloped floor. In such cases the landing zone should be feathered in to any sloped floor in order to ensure a consistent riser height.
- 3.2.3 Variability in the as-built going and riser dimensions has been demonstrated to increase the risk of falling on stairs. See CIRIA C722 'Safer stairs in public places – assessment of existing stairs' for further information. These variations can be a result of off-site fabrication or changes to the build-up of floor finishes at the top and bottom landings. For new and altered assets, designers and installers should ensure that the risk of introducing variable goings and risers is minimised. Where variations in existing stair treads and risers are identified, mitigations may be employed to reduce the risk of falling. Refer especially to Chapter 7 Improving stairs.
- 3.2.4 The limit and extent of the stairway should be clearly defined in order to assist users, especially those who are visually impaired. For example, there should be no surface, finish or floor pattern at the top or bottom landings that could be mistaken for a step.
- 3.2.5 BS 5395-1 states that stair risers should be closed rather than open. Open risers may be used in stairs that are used solely for maintenance access.
- 3.2.6 Consecutive steps with closed risers should overlap each other by a minimum of 0mm and a maximum of 25mm. If a stair is solely for maintenance and has open risers, the step overlap should not be less than 15mm. The step overlap should be consistent for all steps in flights between two floors.
- 3.2.7 In accordance with S1133 Premises – Stairways and Ramps, the maximum number of risers per flight is 20. In accordance with Part K of the Building Regulations, no stairway should have more than 36 risers in consecutive flights before the stair makes a change of direction.
- 3.2.8 In accordance with S1133 Premises – Stairways and Ramps, public stairs shall be weather protected and public escape stairs should preferably also be protected. Where stairs do have exposure to the weather, they should not slope in any direction by more than 1:40 and should be free draining in order to ensure that water does not collect and freeze.
- 3.2.9 Stairway clear width shall be calculated in accordance with S1371 Station planning. Ramp clear width requirements are set out in BS 8300. Stairs and ramps should be clear of any obstruction that reduces the width below the minimum required. Any obstruction resulting in a width reduction should be provided with a guard rail.
- 3.2.10 The structural width of stairways and ramps shall be determined by the minimum clear distance required between handrails, plus the dimension required for any central and wall handrails plus clearance between wall handrails and any wall finish plus the thickness of any finishes to the structure.
- 3.2.11 BS 5395-1 states that single steps which form part of a circulation route are likely to cause a trip hazard and should not be used. Single steps which provide access to the building should also be avoided. See BS 8300 for further advice.
- 3.2.12 BS 5395-1 states that in stair flights the minimum number of risers shall be 3, unless the flight provides access to the building. Where a flight of 2 risers are provided at the access to a building it should be treated as a stair and should have handrails to each side as well as other stair elements such as corduroy hazard warning surface and contrasting stair nosings. A ramped access should also be provided, unless access is for maintenance only.
- 3.2.13 BS 5395-1 states that doors which open onto a stair landing and obstruct the landing area shall not be permitted.
- 3.2.14 Stairway run-offs should be of consistent width, have no obstructions and be no narrower than the width between the stair side handrails. The lengths of run-offs are described in S1371 Station planning.

- 3.2.15 Zones below stairways which are used for public circulation shall have headrooms in compliance with S1371 Station planning. Any zone with restricted headroom should be enclosed with, as a minimum, a guard rail.
- 3.2.16 Ramp gradients are described in S1133 Premises – Stairways and Ramps but further detail on the limits of the gradient in relation to the going of the flight is contained in BS 8300. No single ramp flight should have a length greater than 10m or a rise greater than 500mm before a landing is introduced.
- 3.2.17 The surface of a ramp should contrast visually with the adjacent landings and edge protection or wall in order that it can be easily identified by visually impaired people.
- 3.2.18 Consideration should be given to security. Stairs and ramps should be designed to ensure that there are no hidden recesses, voids or places of concealment.
- 3.2.19 On all public stairs and ramps there should be no gap on the stair or on the guarding which allows a 100mm sphere to pass through to prevent a child from falling or becoming entrapped.
- 3.2.20 Due consideration should be given to the selection of finishes on stairs and ramps to ensure that the correct slip resistance is achieved, as described in S1133 Premises – Stairways and Ramps. To maintain traction, a sloping surface should have a higher slip resistance than an equivalent level surface. As a consequence, a change from the adjacent floor finish may be required for ramp flights.

3.3 Handrails

- 3.3.1 Handrails provide a guide to where a stair or ramp begins and ends, they facilitate the movement up and down the stair or ramp, they assist in preventing a fall if loss of balance occurs and they mitigate the risk of injury in the event of a fall. It is essential that a handrail is suitably designed in order to best perform these functions.
- 3.3.2 Handrails should be continuous to both sides of a stair or ramp, including flights and landings. This excludes ramps at the end of station platforms and ramps associated with platform humps where handrails are not required. For maintenance stairs of less than 1200mm width, a minimum of one handrail is required. For embankment/cutting steps requirements, refer to S1054 Civil Engineering – Earth structures.
- 3.3.3 Where handrails would otherwise cross doors located on landings, the handrail should terminate on either side of the door and a suitable handrail element designed to be affixed to the door which will optimise the continuity of the stair handrail whilst allowing the door to function.
- 3.3.4 Handrails should be fixed at a vertical height of between 900mm and 1000mm measured from the pitch line of the stair or ramp floor surface to the top of the handrail. At the intermediate landings, the handrail height should be between 900mm and 1100mm.
- 3.3.5 On public stairs and ramps, a second lower handrail should be provided in accordance with Part M of the Building Regulations and BS 8300. The handrail height should be fixed at a vertical height of 600mm measured from the pitch line of the stair or ramp floor surface to the top of the handrail.
- 3.3.6 No handrail should be installed across a means of escape or restrict movement, especially at the top and bottom of stairs and ramps.
- 3.3.7 Handrails should extend at least 300mm beyond the top and bottom nosing or end of ramp provided they do not extend into circulation routes. This is not required on stairs or ramps which are solely for maintenance access. Handrails should be terminated in such a way that reduces the risk of clothing or carried items being snagged. For example, the handrail may be returned to the wall or returned down, finished with a rounded end or a scroll.
- 3.3.8 Central handrails should be provided in accordance with the stairway width requirements in Station planning and ramp width requirements in BS 8300. The handrails should break at every landing with a minimum clear gap of 1800mm to allow for cross circulation. This clear gap requirement may preclude the 300mm extension at the top and bottom of a flight described in clause 3.3.7.

- 3.3.9 Handrails should have a smooth continuous surface, be comfortable to grip whilst ideally providing resistance against hand slippage. There should be no sharp edges (less than 3mm radius), projections, finger traps (gaps between 8mm and 25mm) or other features which may cause injury, entrapment or damage to clothing. Connections between lengths of handrail should be tightly butt-jointed with no flash gap detail.
- 3.3.10 The handrail shape and dimension is important and should allow users to make a firm grasp. It should ideally be circular in section with a diameter of between 40mm and 45mm. Oval handrails should be 50mm wide by 40mm high.
- 3.3.11 The distance between the handrail and the wall should be such that it allows for the handrail to be continuously and firmly grasped whilst reducing the risk of the user's arm being trapped in the event of a fall. A zone of between 50mm and 75mm is recommended.
- 3.3.12 In order to allow for a firm grasp of the handrail, there should be a zone of 50mm below the handrail. Cranked handrail brackets may not project into this zone. Refer to Part M of the Building Regulations for further information. In accordance with S1133 Premises - Stairways and Ramps, there shall be a clear zone of 600mm above the handrail in order that it can be grabbed easily in the case of loss of balance.
- 3.3.13 Handrails should be poor conductors of heat and not become excessively hot or cold to touch. The selection of an appropriate material or finish also needs to consider the need for the handrail to be resistant to malicious damage and wear. Some coatings and coverings are not sufficiently hard or durable in heavily trafficked environments and wear quickly.
- 3.3.14 Handrails should be finished to provide visual contrast with the background against which they are seen.
- 3.3.15 For fixed ladders, a safety cage should be provided in accordance with BS EN ISO 14122 – 4 and BS 4211 to protect people from falling.

3.4 Nosings

- 3.4.1 The front edge of tread or landing is typically referred to as the nosing. Applied nosings are a material added to the leading edge of a tread to provide visual contrast to the step and can also be used to protect the tread material from wear or damage. In accordance with BS 8300 and BS 5395, visual contrast shall be achieved by incorporating a permanently contrasting material for the full width of the stair on both tread and riser in order to assist blind and partially sighted people in identifying both the extent of the stairs and the individual treads. The material should be 50mm to 65mm on the tread and 30mm to 55mm on the riser. A number of compliant proprietary nosings are 55mm x 55mm.
- 3.4.2 Whilst stairs used solely for maintenance access will not typically be used by visually impaired people, where they are subject to heavy use or when equipment and tools are being transported, consideration should be given to applied nosings in order to protect the edge of the steps from damage.
- 3.4.3 Stairs should not have sharp edged nosings (less than 3mm radius) as these can increase the risk of injury in the event of a fall. Likewise, the nosing should not have a rounded nosing with a large radius as this reduces the effective going and could also be a slip hazard. It is recommended that the radius does not exceed 16mm.
- 3.4.4 A very smooth surface on the edge of the nosing is not desirable, especially where the stair is likely to get wet. The nosing should have a good slip resistance as identified in S1133 Premises – Stairways and Ramps. The slip resistance of the applied nosing material should not diminish with wear.
- 3.4.5 It is essential that nosings are well maintained. Applied nosings which are damaged or come loose from the step represent a significant risk of tripping and falling. Visual contrast should also be maintained. This may require periodic replacement or re-application of the material used to achieve the visual contrast.

- 3.4.6 Nosings are subject to heavy use, particularly in highly trafficked locations. Typical solutions for both new and existing stairs are described below. Cast metal nosings in cast iron, gunmetal and nickel bronze have traditionally been used on London Underground public stairs and have a proven track record of performance. Option a) is now non-compliant with requirements to achieve a permanently contrasting nosing and should only be used for maintenance. Alternative overlays or nosings may be used provided the performance of the traditional inserts can be achieved. Whole life costings may be part of this consideration. Options f) and g) are only suitable for consideration on existing stairs where the applied nosings may be in good condition, but do not have the required contrast.

Options for stair nosings that may be considered are:

- a) Heavy Duty London Transport (HDLT) pattern stair nosing as detailed in Figure 1 and 2 have traditionally been used on public stairs in LU premises. However, this style does not comply with the requirements of BS 5395-1 and BS 8300 and may only be used for the maintenance of existing stairs. Highlighting of the nosing will additionally have to be addressed.
- b) Cast metal stair nosings have been developed which are the compliant equivalent of the traditional nosings. These retain the same dimension on the tread (140mm on the step and 280mm on the landing) but have a 55mm return 'leg'. Both the leg and the front of the tread have coloured inserts to provide visual contrast with the step. These are illustrated in S1133 Premises – Stairways and Ramps.
- c) Variations of the cast metal stair nosings with a smaller dimension on the tread have also been developed. These may be selected for cost or aesthetic reasons. In specifying these, the designer should satisfy themselves that adequate and robust fixings into the stair construction can be achieved.
- d) Aluminium extruded nosings with coloured inserts may be suitable on stairs with low traffic such as staff stairs. Trials on highly trafficked public stairs have demonstrated that fixings may pull through the metal over time and that their service life is short. They may need regular replacement and this should be a consideration when specifying.
- e) GRP (Glass Reinforced Plastic) products are available on the market either as an applied nosing or as a tread overlay and have been used on some relatively low traffic areas in the London Underground environment.
- f) Resin can be site applied to existing stairs to achieve visual contrast to the nosings. Slip resistance is high but the visual contrast may be reduced over time as a consequence of dirt accumulation. The resin also wears and regular re-application is required in heavily trafficked locations.
- g) Paint can be site applied to existing stairs to achieve visual contrast to nosings. The paint will require additives to achieve an acceptable slip resistance. This solution is acceptable only when no other option is available. Paint is not durable in this application and wears quickly, the consequence being that the visual contrast is lost. Regular re-painting may be necessary to retain compliance and it therefore represents a significant maintenance liability.

3.5 Corduroy Hazard Warning Surface

- 3.5.1 Corduroy hazard warning surfaces are commonly referred to as corduroy tactiles. In order to comply with Building Regulations and with the Department for Transport Guidance on the use of tactile paving surfaces, they are required at the top and bottom of a series of flights on public stairs but not on internal staff/escape stairs or on any maintenance stairs. Corduroy hazard warning surfaces are not required at the top and bottom of any ramps.
- 3.5.2 The purpose of corduroy hazard warning surfaces is to warn visually impaired people of the presence of stairs which could be a hazard if approached without any indication. The profile and plan of the warning surface is illustrated in Figure 3.

- 3.5.3 The setting-out and relationship of the corduroy hazard warning surfaces to the top and bottom of the stairs are illustrated in Figure 4. Further information on the setting-out is contained in Guidance on the use of tactile paving surfaces.
- 3.5.4 Corduroy hazard warning surfaces should not be installed on intermediate landings as the presence of the continuous handrail is sufficient warning that the stair continues. However, the warning surface should be installed on an intermediate landing if the stair can be accessed at that landing.
- 3.5.5 Corduroy hazard warning surfaces should visually contrast with the adjacent surfaces and be slip resistant.

3.6 Stair and Ramp Finishes

- 3.6.1 Stair and ramp finishes in public areas are as defined in S1135 – Premises Finishes, the associated G0135 Guidance on Finishes and S&SD guidance.
- 3.6.2 Stair and ramp finishes in staff areas are as defined in G-371C Operational Staff Accommodation Design Guidance Document.
- 3.6.3 Escape stairs should be fit for purpose, durable and slip resistant. Decorative finishes are not required but there should be good visual contrast on the handrails and nosings.
- 3.6.4 Maintenance stairs – decorative finishes are not required. Steps and landings should be durable and slip resistant. Walls that form any stairwell should be impact resistant.

4 Responsibilities

- 4.1 Those involved in the design, specification and installation of stairways and ramps on any London Underground property – both as a maintenance or a project activity – should note the contents of this guidance note.

5 References

5.1 References

5.1.1 British Standards

Document no.	Title
BS EN ISO 14122	Safety of machinery. Permanent means of access to machinery
BS 4211	Specification for permanently fixed ladders
BS ISO 15686-1	Buildings and constructed assets - Service life planning: General Principles
BS ISO 15686-2	Buildings and constructed assets - Service life planning: Service Life prediction procedures
BS 5395-1	Stairs – Part 1: Code of practice for the design of stairs with straight flights and winders.
BS 5395-2	Stairs, ladders and walkways. Code of practice for the design of helical and spiral stairs.
BS 5395-3	Stairs, ladders and walkways. Code of practice for the design of industrial type stairs, permanent ladders and walkways
BS8300:	Design of Buildings and their approaches to meet the needs of disabled people – Code of practice

5.1.2 Industry codes of practice

Document no.	Title
CIRIA C722	Safer stairs in public places – assessment of existing stairs.

5.1.3 TfL company documents

Document no.	Title
S1133	Premises – Stairways and Ramps
S1135	Premises - Finishes
S1132	Premises – Barriers and Fencing (Non-Lineside)
S1371	Station Planning
S1053	Civil Engineering – Building and Station Structures
S1054	Civil Engineering – Earth structures
S1622	Glossary of Terms and Abbreviations
S1035	Location coding system
G0135	Guidance on Finishes
G0132	Guidance on Barriers and Fencing
G-371C	Operational Staff Accommodation Design Guidance Document

5.1.4 Other

Document no.	Title
Dept for Transport	Guidance on the use of tactile paving surfaces.

5.2 Person accountable for the document

Person accountable for the document
██████████ – Principal Premises Engineer

5.3 Document history

Issue no	Date	Changes	Author
A1	March 2014	As per DRACCT No. 01956. Guidance Document produced to support S1133 Premises – Stairways and Ramps.	██████████

6 Attachments

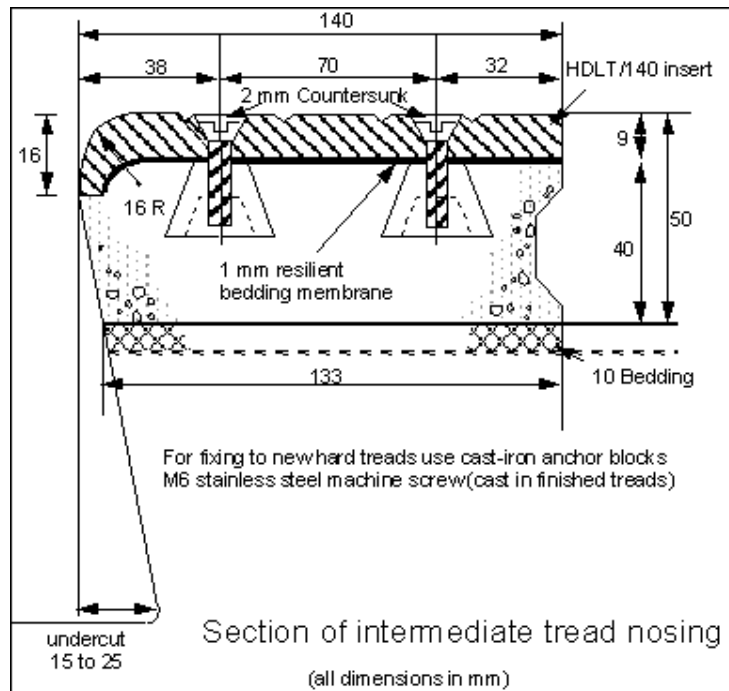


Figure 1 - 140mm HDLT stair nosing and fixing

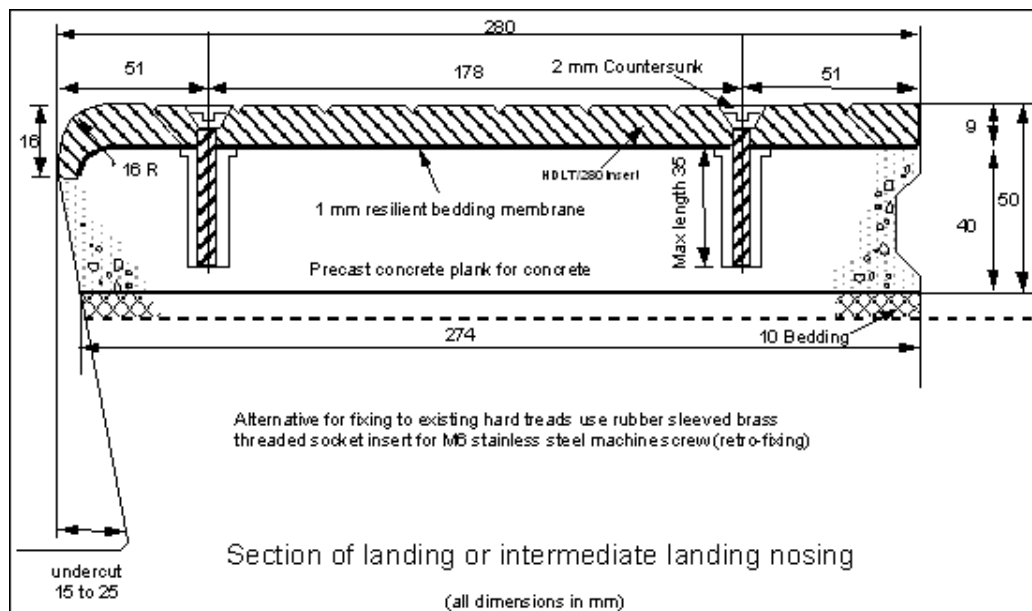


Figure 2 - 280mm HDLT stair nosing insert and fixings

To be used for maintenance purposes only.

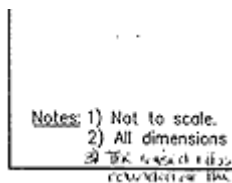


Figure 3 – Corduroy hazard warning surface

(Figure extracted from Guidance on the use of tactile paving surfaces. Department for Transport, published 2007)

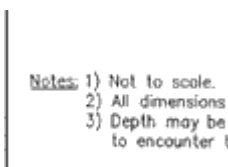


Figure 4 – Setting-out of corduroy hazard warning surface at stairs

(Figure extracted from Guidance on the use of tactile paving surfaces. Department for Transport, published 2007)