EVACUATING VULNERABLE AND DEPENDENT PEOPLE FROM BUILDINGS IN AN EMERGENCY

How should people who are elderly or ill, or children, be evacuated from buildings, residential care, healthcare and domestic premises? This guide provides support for designers, owners and managers of buildings so that they can formulate efficient strategies for the effective evacuation of people with mobility impairments.

Qualitative guidance is given to illustrate the considerations that need to be made when developing an evacuation strategy that will be as inclusive as practicably possible. Formulae and data are also provided in order to quantify the relationship that exists between the size and nature of a population that may need evacuating, the resources that are available to effect that evacuation and the level of fire protection afforded by the building requiring evacuation.

Related titles from IHS BRE Press

Evacuation Modelling and Human Behaviour in Fire
DC 516

Automatic Fire Sprinkler Systems
A good practice guide
FB 19

David Crowder and David Charters

IHS BRE Press, Willoughby Road, Bracknell, Berkshire RG12 8FB
www.brebookshop.com
EVACUATING VULNERABLE AND DEPENDENT PEOPLE FROM BUILDINGS IN AN EMERGENCY

David Crowder and David Charters
This work has been funded by BRE Trust. Any views expressed are not necessarily those of BRE Trust. While every effort is made to ensure the accuracy and quality of information and guidance when it is first published, BRE Trust can take no responsibility for the subsequent use of this information, nor for any errors or omissions it may contain.

The mission of BRE Trust is ‘Through education and research to promote and support excellence and innovation in the built environment for the benefit of all’. Through its research programmes BRE Trust aims to achieve:
• a higher quality built environment
• built facilities that offer improved functionality and value for money
• a more efficient and sustainable construction sector, with
• a higher level of innovative practice.

A further aim of BRE Trust is to stimulate debate on challenges and opportunities in the built environment.

BRE Trust is a company limited by guarantee, registered in England and Wales (no. 3282856) and registered as a charity in England (no. 1092193) and in Scotland (no. SC039320).

Registered Office: Bucknalls Lane, Garston, Watford, Herts WD25 9XX

BRE Trust
Garston, Watford WD25 9XX
Tel: 01923 664743
Email: secretary@bretrust.co.uk
www.bretrust.org.uk

BRE Trust and BRE publications are available from
www.brebookshop.com
or
IHS BRE Press
Willoughby Road
Bracknell RG12 8FB
Tel: 01344 328038
Fax: 01344 328005
Email: brepress@ihs.com

Requests to copy any part of this publication should be made to the publisher:
IHS BRE Press
Garston, Watford WD25 9XX
Tel: 01923 664761
Email: brepress@ihs.com

Printed on paper sourced from responsibly managed forests

FB 52
© Copyright BRE 2013
First published 2013
ISBN 978-1-84806-264-1
# CONTENTS

Acknowledgements ................................................ iv
Executive summary .................................................. v

1 INTRODUCTION .................................................. 1

2 ROLES .............................................................. 2
   2.1 Fire safety management ...................................... 2
   2.2 Role of front-line staff ....................................... 2

3 AVAILABLE SAFE EGRESS TIME AND REQUIRED SAFE EGRESS TIME .......... 3

4 EVACUATION OF PATIENTS .................................. 5

5 EVACUATION STRATEGIES .................................... 6
   5.1 Simultaneous evacuation ..................................... 6
   5.2 Progressive horizontal evacuation ......................... 6
   5.3 Defend-in-place strategy .................................... 7

6 POINTS TO CONSIDER WHEN EVACUATING MOBILITY-IMPAIRED PEOPLE .... 8

7 TRAINING .......................................................... 10
   7.1 General ........................................................... 10
   7.2 Back care ....................................................... 10
   7.3 Infection control .............................................. 11

8 EVACUATION AIDS AND TECHNIQUES .......................... 12

9 ENSURING CONTINUITY OF CARE ............................. 14

APPENDIX A: NATURE OF FIRE ................................ 15

APPENDIX B: EVACUATION DATA ................................ 16
   B1 Individual evacuations ....................................... 16
   B2 Evacuation data .............................................. 16

APPENDIX C: VERTICAL EVACUATION ............................. 19
   C1 Introduction .................................................... 19
   C2 Pilot tests ..................................................... 19
   C3 Results ......................................................... 19

APPENDIX D: CALCULATION OF EVACUATION TIME ...................... 21
   D1 Introduction .................................................... 21
   D2 Calculating indicative evacuation times .................. 23

10 REFERENCES ..................................................... 25
ACKNOWLEDGEMENTS

The research undertaken for the production of this guide was carried out and supported by the following people and organisations. Their expertise and the generous contribution of their time made a significant contribution to the value of the research:

- Paul Roberts, Department of Health
- Phil Cane, National Association of Healthcare Fire Advisors
- Peter Aldridge, Leeds Teaching Hospitals NHS Trust
- Derek Bond, Bolton Hospitals NHS Trust
- Stephen Harrup, The Ipswich Hospital NHS Trust
- Su Peace, QEquality
- Dr Karen Boyce, University of Ulster
- Dr Charles Hancock, Loughborough University
- Peter Wilkinson, Fire Protection Association
- Janette Midda, Weston Area Health Trust
- Roy Benjamin, Birmingham City Council.

The authors would like to thank BRE Trust for its support and funding, without which this research could not have been undertaken.
EXECUTIVE SUMMARY

This guide has been written for those involved in developing plans and strategies for evacuating premises containing large proportions of people with mobility impairments:
- fire safety managers
- facilities managers
- nursing staff, particularly staff responsible for the day-to-day care of those with mobility impairments
- architects and designers
- fire safety engineers
- approval authorities.

It is intended to provide some understanding of:
- The role of fire safety management, and its interaction with the role of front-line staff.
- The role of fire protection systems in buildings and the role of appropriately trained staff, and the importance of striking a balance between fire protection levels and staffing levels:
  - fire detection and alarm systems and their effect on pre-movement time, reducing the Required Safe Egress Time
  - suppression systems controlling fires, increasing the Available Safe Egress Time
  - passive fire protection systems containing fires, increasing the Available Safe Egress Time.
- The amount of time available for evacuating people, and how this is determined by the level of fire protection provided throughout a building. The greater the level of protection designed into a building, the greater the time will be available for evacuation to be completed, and the smaller the number of staff that will be required to assist in that evacuation.
- The different strategies that are available for protecting building occupants, particularly those with mobility impairments, from fire.
- The potential difference in the levels of a person’s ability to carry out horizontal or vertical movement.
- Points to consider in evacuating people with mobility impairments.
- Techniques available for evacuation.
- The importance of training in maximising the effectiveness of staff helping to evacuate people with mobility impairments.
- Ensuring that care can continue to be provided to individuals, where necessary, after an evacuation has been completed.

Appendices have been provided to give more information on the behaviour of fire, as well as on some of the findings of the data analysis carried out during the drafting of this guide.

The research presented in this guide was undertaken before the investigation into the Rosepark care home fire was published, but much of the information it contains should help to prevent future similar fire events.
1 INTRODUCTION

There is no simple way to know how long it will take a person with mobility impairments, or a highly dependent person, to evacuate or be evacuated from a building before conditions become untenable because of fire. For example, in the attack on the World Trade Center in 2001, over 1000 surviving occupants had a limitation that affected their ability to evacuate, including recent surgery or injury, obesity, heart condition, asthma, advanced age and pregnancy. An investigation into the evacuation indicates that evacuation flow rates were approximately half those normally observed in fire drills[1].

Recent fires, such as those at the Rosepark care home (where 14 people died)[2] and at Warrington District General Hospital (three staff were injured while evacuating patients) illustrate how society’s most vulnerable people are at risk from fire.

In addition, many of the 400 or so attendees at a series of seven fire safety seminars run by BRE indicated that ‘if they had a magic wand, the fire safety problem they would like to solve’ would be the need for a better understanding of evacuation of mobility-impaired people. Delegates’ responses included the following:

‘Realistic evacuation times/travel distances for residential care premises.’

‘Evacuation time/staff ratio in respect of residential care premises. We include figures for staffing levels and bed complement in compartments. We will probably have to step back from this in future – I’m not aware of any research re dependency of patient/staff and travel distances.’

‘Patient evacuation training – how far, how long, health and safety issues, legal issues, physical – should actual patients be involved?’

‘The effectiveness of signage in a fire.’

A research programme was therefore commissioned by BRE Trust to consider the means of evacuating people who are elderly or ill, or children, from buildings – residential care, healthcare and domestic premises.

This guide has been written as the outcome of that research. It aims to provide support for designers, owners and managers of buildings so that they can formulate efficient strategies for the effective evacuation of people with mobility impairments.

Qualitative guidance is given to illustrate the points to consider when developing an evacuation strategy that will be as inclusive as practicably possible.

Formulæ and data are also provided in order to quantify the relationship that exists between the size and nature of a population that may need evacuating, the resources that are available to effect that evacuation and the level of fire protection afforded by the building requiring evacuation.

This guidance is supplementary to that provided by HTM 05-03: Part K[3] as well as the Fire Safety Risk Assessment Guides, and in particular:

- Fire safety risk assessment supplementary guide: means of escape for disabled people[6].

It is intended for application to buildings that have been designed and constructed according to the Building Regulations[7]. As well as buildings designed to satisfy the recommendations of Approved Document B[8] or HTM 05-02[9], it may be equally suitable for fire-engineered buildings.

This guide has been prepared particularly for those responsible for buildings in which large numbers of people with mobility impairments are expected to be present. It gives an overview of the nature of existing fire strategies in healthcare premises, particularly with respect to evacuation.

It is intended to provide information for management as well as front-line staff, since it is successful communication between these two groups that will maximise the effectiveness of evacuation strategies.

The research carried out for the production of this guide involved BRE Global gathering information from evacuation drills and real evacuations. Two evacuation drills were organised with the direct involvement of BRE Global, and information (video and questionnaires) was submitted on a further six exercises and two real incidents over the course of a three-year period. The data from these evacuations and evacuation drills cannot be included in this guide for reasons of data protection.

The research presented in this guide was undertaken before the investigation into the Rosepark care home fire was published, but much of the information it contains should help to prevent future similar fire events.
Subsidence damage to domestic buildings: lessons learned and questions remaining. FB 1
Potential implications of climate change in the built environment. FB 2
Behaviour of concrete repair patches under propped and unpropped conditions: critical review of current knowledge and practices. FB 3
Construction site security and safety: the forgotten costs! FB 4
New fire design method for steel frames with composite floor slabs. FB 5
Lessons from UK PFI and real estate partnerships: drivers, barriers and critical success factors. FB 6
An audit of UK social housing innovation. FB 7
Effective use of fibre reinforced polymer materials in construction. FB 8
Summertime solar performance of windows with shading devices. FB 9
Putting a price on sustainability. BRE Centre for Sustainable Construction and Cyril Sweet. FB 10
Modern methods of house construction: a surveyor's guide. FB 11
Crime opportunity profiling of streets (COPS): a quick crime analysis – rapid implementation approach. FB 12
Subsidence damage to domestic buildings: a guide to good technical practice. FB 13
Sustainable refurbishment of Victorian housing: guidance, assessment method and case studies. FB 14
Putting a price on sustainable schools. FB 15
Knock it down or do it up? FB 16
Micro-wind turbines in urban environments: an assessment. FB 17
Siting micro-wind turbines on house roofs. FB 18
Automatic fire sprinkler systems: a guide to good practice. FB 19
Complying with the Code for Sustainable Homes: lessons learnt on the BRE Innovation Park. FB 20
The move to low-carbon design: are designers taking the needs of building users into account? FB 21
Building-mounted micro-wind turbines on high-rise and commercial buildings. FB 22
The real cost of poor housing. FB 23
A guide to the Simplified Building Energy Model (SBEM): what it does and how it works. FB 24
Vacant dwellings in England: the challenges and costs of bringing them back into use. FB 25

Energy efficiency in new and existing buildings: comparative costs and CO₂ savings. FB 26
Health and productivity benefits of sustainable schools: a review. FB 27
Integrating BREEAM throughout the design process: a guide to achieving higher BREEAM and Code for Sustainable Homes ratings through incorporation with the RIBA Outline Plan of Work and other procurement routes. FB 28
Design fires for use in fire safety engineering. FB 29
Ventilation for healthy buildings: reducing the impact of urban pollution. FB 30
Financing UK carbon reduction projects. FB 31
The cost of poor housing in Wales. FB 32
Dynamic comfort criteria for structures: a review of UK standards, codes and advisory documents. FB 33
Water mist fire protection in offices: experimental testing and development of a test protocol. FB 34
Airtightness in commercial and public buildings. 3rd edn. FB 35
Biomass energy. FB 36
Environmental impact of insulation. FB 37
Environmental impact of vertical cladding. FB 38
Environmental impact of floor finishes: incorporating The Green Guide ratings for floor finishes. FB 39
LED lighting. FB 40
Radon in the workplace. 2nd edn. FB 41
U-value conventions in practice. FB 42
Lessons learned from community-based microgeneration projects: the impact of renewable energy capital grant schemes. FB 43
Energy management in the built environment: a review of best practice. FB 44
The cost of poor housing in Northern Ireland. FB 45
Ninety years of housing, 1921–2011. FB 46
BREEAM and the Code for Sustainable Homes on the London 2012 Olympic Park. FB 47
Saving money, resources and carbon through SMARTWaste. FB 48
Concrete usage in the London 2012 Olympic Park and the Olympic and Paralympic Village and its embodied carbon content. FB 49
A guide to the use of urban timber. FB 50
Low flow water fittings: will people accept them? FB 51
EVACUATING VULNERABLE AND DEPENDENT PEOPLE FROM BUILDINGS IN AN EMERGENCY

How should people who are elderly or ill, or children, be evacuated from buildings, residential care, healthcare and domestic premises? This guide provides support for designers, owners and managers of buildings so that they can formulate efficient strategies for the effective evacuation of people with mobility impairments.

Qualitative guidance is given to illustrate the considerations that need to be made when developing an evacuation strategy that will be as inclusive as practicably possible. Formulae and data are also provided in order to quantify the relationship that exists between the size and nature of a population that may need evacuating, the resources that are available to effect that evacuation and the level of fire protection afforded by the building requiring evacuation.

David Crowder and David Charters

RELATED TITLES FROM IHS BRE PRESS

EVACUATION MODELLING AND HUMAN BEHAVIOUR IN FIRE
DG 516

AUTOMATIC FIRE SPRINKLER SYSTEMS
A good practice guide
FB 19