Property flood resilience (PFR) is an important part of the response to flood risk. PFR includes measures to reduce the risks to people and property, enabling households and businesses to reduce flood damage, speed up recovery and reoccupation. PFR measures should reduce the amount of water entering buildings (known as resistance measures), or limit the damage caused if water does enter a building (known as recoverability measures).

This code of practice (CoP) is concerned with PFR measures that can be introduced to buildings at risk from flooding. Often these measures can be installed as part of the repair of buildings after a flood event. However, some property owners may wish to be proactive and fit measures in anticipation of a flood.

The CoP includes six standards that specify what should be achieved. These standards are supported by comprehensive guidance on how the standards should be met by following stages within a PFR delivery process. The guidance is provided in CIRIA C790B Code of practice and guidance for property flood resilience, which will be published in 2020.
**Who we are**

CIRIA members lead the industry in raising professional standards through collaboration, sharing knowledge and promoting good practice. Recognised as leaders in industry improvement, CIRIA’s members represent all construction stakeholder groups including clients, contractors, consultants, public sector champions, regulators and academia.

CIRIA membership provides organisations with a unique range of business development and improvement services, focused on sharing and embedding research, knowledge and good practice. In addition to the many direct benefits, membership provides a wealth of opportunities for organisations to engage in shaping, informing and delivering industry solutions focused on innovation and improvement.

In addition to representing excellent value for money in terms of direct benefits, CIRIA membership delivers significant returns for organisational investment in business improvement and development, CPD, industry engagement, profile enhancement and collaborative research.

CIRIA membership allows your employees to access the full breadth of CIRIA resources and services, creating valuable networking, performance improvement and leadership opportunities.

In addition to CIRIA membership, there is a range of specialist community of practice memberships available:

- **CIRIA book club**
  The CIRIA book club allows you to buy CIRIA publications at half price – plus free copies of all new guidance for Gold subscribers.

- **Local Authority Contaminated Land (LACL) network**
  LACL helps local authority officers to address responsibilities and duties involving land contamination and redevelopment.

- **Brownfield Risk Management Forum (BRMF)**
  BRMF provides comprehensive support to all construction, environmental, financial and legal professionals working on brownfield projects.

- **European Marine Sand And Gravel Group (EMSAGG)**
  EMSAGG provides a forum for the marine aggregate industry across Europe to discuss sector issues and exchange ideas and learning.

**Where we are**

Discover how your organisation can benefit from CIRIA’s authoritative and practical guidance – contact us by:

- **Post** Griffin Court, 15 Long Lane, London, EC1A 9PN, UK
- **Telephone** +44 (0)20 7549 3300
- **Fax** +44 (0)20 7549 3349
- **Email** enquiries@ciria.org
- **Website** www.ciria.org

For details of membership, networks, events, collaborative projects and to access CIRIA publications through the bookshop.
Code of practice for property flood resilience

Edition 1

David Kelly, BRE
Matt Barker, RAB Consultants (formerly BRE)
Jessica Lamond, University of the West of England
Steve McKeown, Whitehouse Construction
Eleanor Blundell, Environment Agency
Summary

Property flood resilience (PFR) is an important part of the response to flood risk. PFR includes measures that reduce the risks to people and property enabling households and businesses to reduce flood damage, speed up recovery and reoccupation. PFR measures should reduce the amount of water entering buildings (known as resistance measures), or limit the damage caused if water does enter a building (known as recoverability measures).

This code of practice (CoP) is concerned with PFR measures that can be introduced to buildings at risk from flooding. Often these measures can be installed as part of the repair of buildings after they have been flooded. However, some property owners may wish to be proactive and fit measures in anticipation of a flood.

The CoP includes six standards that specify what should be achieved. These standards will be supported by comprehensive guidance on how the standards should be met by following stages within a PFR delivery process. The guidance is provided in CIRIA C790B Code of practice and guidance for property flood resilience, which will be published in 2020.
Acknowledgements

This guide is the result of CIRIA Research Project (RP)1055. It has been written under contract to CIRIA by a consortium led by BRE which included University of the West of England, Whitehouse Construction and the Environment Agency.

Authors

David Kelly PhD PgCert BSc (Hons)
David is a group director with BRE. David’s background is in building physics and he now leads three elements of BRE’s business – Innovation Parks Network (includes Parks in UK, China, Brazil, Chile and Canada), the Centre for Resilience, and BRE in Scotland. The BRE Innovation Park concept has been established to support the development and implementation of Government policies in relation to issues such as construction innovation, sustainability, energy efficiency, health and wellbeing, resilience and climate change. BRE’s Centre for Resilience focuses on climatic resilience (including flooding), societal resilience (related to ageing), and energy resilience. This role also involves engaging with public and private sector partners, governments, academics and supply chain partners, within the UK and internationally.

Matthew Barker BSc (Hons)
Matthew Barker is a property flood resilience (PFR) surveyor and has been working primarily in the field of flood risk management for the duration of this career. He currently project manages schemes for independent surveys on behalf of local authorities and environmental agencies nationally and looks at how properties can be made more resilient to the impacts of flooding. Matt has also be heavily involved with the development and delivery of a range of training materials and research projects around increasing the resilience of properties to flood risk in the UK.

Jessica Lamond PhD MSc BSc (Hons) AFHEA
Jessica is a professor in real estate and climate risk, and co-director of the Centre for Architecture and Built Environment Research at the University of the West of England. Jessica has more than 15 years’ experience researching PFR and flood recovery including socio-technical aspects of uptake, property valuation and insurance. She has led projects for a wide variety of funders including EPSRC, DFID, Defra, RICS and Flood Re. Jessica is co-author of the World Bank handbook on urban flood management and is co-editor of two books in the area of flooding and climate change.

Steve McKeown HND MBA
Steve has been involved in business management and civil engineering for over 30 years. During this time, he has been involved in the continuous improvement of service delivery across many sectors, including water. Steve is managing director at Whitehouse Construction and is responsible for safety. The organisation has delivered PFR since 2005, and they have been involved in many industry initiatives including, thought leadership roundtables and the production of PAS 1188-2014. Steve is dedicated to bringing rigour and robustness into the delivery of PFR so that those at risk of flooding can have greater confidence in flood resilience.

Eleanor Blundell BA (Hons)
Eleanor has worked for the Environment Agency for over 10 years, including in a number of flood risk and coastal erosion related roles. She has worked on several projects within the Environment Agency with a major stakeholder focus, including the Coastal Refresh, the Cumbria Floods Partnership in 2015, the Flood and Coastal Erosion Risk Management Strategy for England. In addition to this, she holds an incident response role within the Environment Agency.
**Project steering group**

Following CIRIA’s usual practice, the project was guided and supported by a project steering group (PSG) that comprised:

- John Alexander Aquobex
- Alex Back* Buckinghamshire County Council
- David Balmforth (chair) Stantec and Institution of Civil Engineers
- Edward Barsley University of Cambridge
- Eleanor Blundell Environment Agency
- Sally Boorer NHBC (now retired)
- Neil Bresler* Cherish Insurance Brokers
- Angela Byrne Welsh Government
- Graham Brogden Aviva (now retired)
- Russell Burton RAB Consultants
- Peter Caplehorn* Construction Products Association
- Alastair Chisholm Chartered Institution of Water and Environmental Management
- Paul Cobbing National Flood Forum
- Francis Comyn Rochdale Borough Council
- Angela Connelly* University of Manchester
- Richard Coutts* Baca Architects
- Robbie Craig Defra
- Alan Cripps Royal Institution of Chartered Surveyors (now retired)
- Mary Dhonau MDA Community Flood Consultants and Know Your Flood Risk
- Paul Everell* Local Authority Building Control
- Jill Fairweather* Welsh Government
- Phil Foxley* Environment Agency
- Debi Garft Scottish Government
- Ian Gibbs Sedgwick
- Jonathan Glerum Anglian Water
- Steve Grebby* Consumer Council for Water
- Michael Green Hydrogreen Consulting (formerly Warwickshire County Council)
- Paul Hendy Scottish Flood Forum
- Stephen Hodgson Property Care Association
- Laura Hughes Association of British Insurers
- Peter May JBA Consulting
- Terry McAlpine Central Bedfordshire Council
- Seamus McCann DfI Northern Ireland
- Gary McInally Flood Re
- Kelly McLauchlan* Natural Resources Wales
- Thomas McLean Welsh Government
- James Morris Welsh Government
- Alastair Moseley H2O WEM and CIWEM
- Chris Netherton* National Flood School
- Ian Paton Cluttons LLP
- Nick Price MHCLG (now retired)
- Craig Ross Royal Institution of Chartered Surveyors
- Jon Stobart* British Damage Management Association (now Building Validation Solutions)
- Andrew Tagg HR Wallingford
- Hannah Tankard* The Prince’s Business Emergency Resilience Group
- Victoria Tink MHCLG
Elaine Toogood* The Concrete Centre
Gail Walker* Citizens Advice Scotland
Philip Wilbourn Wilbourn Associates
Robert Williams Gwynedd Council
* corresponding members

Project funders
CIRIA would like to acknowledge and thank the following organisations for funding and supporting this work:
Aviva
Environment Agency
Department for Infrastructure Northern Ireland
The Scottish Government/National Centre for Resilience
The Welsh Government

Endorsing organisations
CIRIA would like to thank the following organisations for their support and endorsement:
Chartered Institution of Water and Environmental Management
Institution of Civil Engineers
Royal Institution of Chartered Surveyors

CIRIA project managers
Paul Shaffer Project manager
Clare Drake Publishing manager

Other contributors
As well as recognising the significant additional contributions from the BRE consortium CIRIA would like to recognise and thank the significant contributions and support from:
David Balmforth (chair) Stantec and Institution of Civil Engineers
Francis Comyn Rochdale Borough Council
Mary Dhonau MDA Community Flood Consultants and Know Your Flood Risk
Stephen Garvin Scottish Government (formerly BRE)
Sam Kipling Environment Agency
Ian Paton Cluttons LLP
Nevil Quinn University of the West of England
Carly Rose University of the West of England
Contents

Summary ................................................................. iii
Acknowledgements. ....................................................... iv

1 Introduction ........................................................... 1
  1.1 What is the code of practice? ........................................ 1
  1.2 Who is the CoP for? ............................................... 1
  1.3 Related guidance .................................................. 2

2 The PFR CoP .......................................................... 3
  2.1 How to use the PFR CoP ............................................ 3
  2.2 Terminology ....................................................... 3

3 PFR Standard 1: Hazard assessment .............................. 4

4 PFR Standard 2: Property survey .................................... 5

5 PFR Standard 3: Options development .......................... 6

6 PFR Standard 4: Construction ....................................... 7

7 PFR Standard 5: Commissioning and handover ................ 8

8 PFR Standard 6: Operation and maintenance .................... 9

9 Glossary ............................................................. 10

References ............................................................. 12

Tables
  Table 1.1 Description of CoP and guidance ....................... 2
  Table 2.1 Underpinning requirements to undertake the PFR approach 3
1 Introduction

Property flood resilience (PFR) is an important part of the response to existing and predicted flood risk. This is particularly relevant in areas where it is not possible to protect communities by structural flood defences or where it is necessary to manage residual flood risk (where existing defences may be overtopped or fail). PFR, by definition, includes measures that provide a way to reduce the risks to people and property enabling households and businesses to reduce flood damage, speed up recovery, reoccupation of flooded buildings and potentially obtain insurance cover more easily and affordably.

Such measures are aimed at reducing the amount of water from entering buildings (known as resistance measures), or limiting the damage caused if water does enter a building (known as recoverability measures). Recoverable materials and construction methods reduce the probability of permanent damage being caused, maintain structural integrity and aid recovery.

1.1 What is the code of practice?

This code of practice (CoP) is concerned with the physical measures that can be introduced to buildings at risk from flooding. Often PFR measures can be installed as part of the repair of buildings after they have been flooded. However, some property owners may wish to be proactive and fit measures in anticipation of a flood. Throughout this CoP, the term PFR should be taken to mean physical measures applied at the building scale that are aimed at reducing damage to buildings and their contents.

The CoP includes six standards that specify what should be achieved. These standards will be supported by comprehensive guidance on how the standards should be met by following stages within a process. The guidance is provided in CIRIA C790B Code of practice and guidance for property flood resilience, which will be published in 2020.

The standards provide a benchmark for good practice to support the consistent and effective implementation of PFR. They are:

- Standard 1: Hazard assessment.
- Standard 2: Property survey.
- Standard 3: Options development.
- Standard 4: Construction.
- Standard 5: Commissioning and handover.
- Standard 6: Operation and maintenance.

1.2 Who is the CoP for?

The CoP is designed to be used by a variety of individuals involved in delivery of PFR, including:

- property owners, occupiers and managers (residential and non-residential)
- engineers, property surveyors, and architects
- manufacturers and suppliers of PFR measures
- construction contractors and installation companies (involved in installing PFR measures)
- local authority planners, developers and regulators specifying PFR for new build and retrofit situations (planners, building control, risk management authorities)
- insurers, loss adjusters and insurance brokers
- sewerage companies.
This CoP applies to residential and non-domestic properties (including both commercial and industrial properties).

### 1.3 Related guidance

These standards are an extract from CIRIA C790B, which will provide extensive guidance on the specification, installation and operation of PFR. CIRIA C790B, which will be available in 2020, will have four main parts that can be read as standalone or as a larger and comprehensive guide to PFR. These are outlined in Table 1.1.

<table>
<thead>
<tr>
<th>Section of document</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part A</strong></td>
<td>This part provides introductory background information on flooding and PFR. This includes information on definitions and overriding principles that are relevant for the document. Part A also includes information on roles and responsibilities, liabilities and contracting approaches that may be relevant for those procuring PFR.</td>
</tr>
<tr>
<td><strong>Part B</strong></td>
<td>This part introduces the six standards that describe specific elements of PFR which should be achieved to improve the resilience of a property. The six standards constitute the CoP and have requirements that should be fulfilled.</td>
</tr>
<tr>
<td><strong>Part C</strong></td>
<td>This part describes the PFR process in six stages, which relate to the six standards of PFR. Each of the stages has a number of steps that guide the user to successfully implementing PFR and deliver the requirements of the CoP.</td>
</tr>
<tr>
<td><strong>Part D</strong></td>
<td>This part provides further information to support the user when implementing PFR. It is linked to the guidance in Part C and provides detailed support to those who require more information.</td>
</tr>
</tbody>
</table>
2 The PFR CoP

The PFR CoP is made up of six standards. Each of these standards have requirements that should be met for them to be achieved. The standards cover the range of activities that should be undertaken to successfully deliver PFR. This CoP is underpinned by three cross-cutting requirements for undertaking PFR as set out in Table 2.1.

Table 2.1 Underpinning requirements to undertake the PFR approach

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Aspects relevant to all stages of PFR delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence of individuals</td>
<td>All aspects of the PFR process should be undertaken by an appropriate person. This individual should act in accordance with a relevant set of professional standards, carry appropriate professional indemnity insurance and be able to demonstrate required levels of skills, knowledge and experience. This may be done through previous work experience, membership of a professional body and/or certificated training. An appropriate person should always act impartially and without favouring any particular supplier of equipment, materials or services.</td>
</tr>
<tr>
<td>Proportionality</td>
<td>It is important that the specification and deployment of PFR is proportionate to the risk to the property and the resources available. For example, if the perceived risk to the property is low then a less detailed and costly property survey may be sufficient. Similarly, if the risk is perceived to be high, then a more detailed survey of the property would be appropriate and more costly PFR measures may be preferred. This common-sense approach should allow a degree of flexibility in relation to the scale of activities undertaken as described within this CoP.</td>
</tr>
<tr>
<td>Provision of PFR information and reports to the end user</td>
<td>All communications and reports should be provided in clear and concise language that is easy to understand and appropriate to the purposes for which it is to be used. It should be sufficiently detailed and comprehensive to fully inform any subsequent stage within the PFR process. Any uncertainties in the information given should be made clear in these reports. Information should also be provided at an appropriate time.</td>
</tr>
</tbody>
</table>

2.1 How to use the PFR CoP

The six standards each consists of:

- a brief introduction that sets out the context
- the aim and purpose
- the requirements stating what should be delivered during that stage of the PFR process. If any requirement is not met, the work will not meet the standard set out in this CoP.

At the end of each PFR delivery stage the aim and requirements of the standards should be checked against what has been delivered. Checklists for this purpose are included in Part D.

2.2 Terminology

The CoP uses the term PFR to refer to any measures that can be applied at a property level to make people and their property less vulnerable to the impacts of flooding. This includes measures to limit physical damage, which can be referred to as resistance and recoverability. These terms have been used in different ways in different publications. For the purposes of this CoP they are defined as follows:

- **Resistance measures**: use of materials and approaches to manage water entry into the property. This relates to water exclusion, i.e. keeping water out.
- ** Recoverability measures**: use of materials, products and construction methods that prevent the internal fabric of the property from being unduly damaged by flood water and allow it to recover quickly after a flood.

Either or both types of measures can be used to make a building more resilient. A **Glossary** is included in this guide.
3 PFR Standard 1: Hazard assessment

Introduction

To comply with PFR Standard 1 a flood hazard assessment shall be undertaken to understand how flooding might threaten a property. This assessment shall include the following:

- likelihood of flooding in the property location (and surrounding areas)
- nature of the flooding that could potentially occur
- likely frequency of flood events for the location – including the potential for increased frequency due to climatic change and/or urban development
- susceptibility of the property and its building(s) to flooding, given its surroundings, design, structure, materials used, condition, and adaptations.

Identifying the flood hazard to a property is a critical element in the development of PFR measures. Conducting a flood hazard assessment can be a detailed and intricate process, often requiring specialised skills to interpret information presented within flood maps or other relevant sources.

Aim

PFR Standard 1 shall deliver a property level flood risk assessment, which clearly summarises the available hazard information to determine the likelihood and severity of flooding from different sources. This information will be used to inform the selection and design of PFR measures.

Requirements

1. A survey of the flood risk to the property shall be carried out. The scale and detail of the survey shall be proportionate to the perceived level of risk and the potential size of the project. Surveys shall be extended should a greater complexity of flood risk become apparent during the survey.

2. The site of the property shall be assessed for the likelihood of flooding based on a ‘source–pathway–receptor’ approach for all potential sources and range of probabilities of flooding.

3. The potential source(s) of flooding shall be determined using appropriate methods of hazard identification. This shall be accompanied by an assessment of flood frequency, as well as depth and duration for all sources at a range of return periods.

4. The property flood risk assessment shall take account of relevant flood risk information from local authorities, utilities and other environment agencies. It shall take account of additional flood risk information from other relevant sources (including property owners).

5. The potential routes of floodwater (pathways) to the buildings/structures within the property from the sources shall be identified.

6. The pathways for flooding from each source to the property and likely speed of onset shall be identified, including measures that currently exist, or are planned, for controlling that pathway at the property, community or catchment scale (including flood defence works). This analysis shall include all relevant structures near to the property.
4 PFR Standard 2: Property survey

Introduction

The identification and delivery of PFR relies upon information provided by a suitably detailed survey of the building(s) at the property. The design, materials, condition, orientation, and exposure of buildings will vary greatly and a survey, unique to each building, is a critical element to identifying suitable resilience measures.

Aim

PFR Standard 2 requires that an appropriate survey of the property and end-user requirements is carried out. The purpose of the survey is to assess the current level of flood resilience of the property to provide the necessary information for the identification of the PFR options suitable for the property. Each building and structure at the property shall be surveyed.

Requirements

1. The scale and detail of the survey shall be proportionate to the level of risk and the size of the project. The survey shall also identify appropriate approaches to increase resilience and minimise damage, with reference to the end-user needs.

2. The survey shall establish the building type, age, construction, condition, operation and contents as described in Defra (2012).

3. The current level of PFR shall be established, including estimating the water leakage resistance capacity of the walls and floors, the recoverability of the materials and components, and end-user capacity to implement measures.

4. The method of drying and decontamination of the building after a flood shall be assessed, including the impact of wetting of building materials and that of voids and cavities in walls and floors.

5. The ground conditions on the site shall be established, and in particular, the potential for water to transfer through the ground or from an adjacent building into the building shall be assessed.
5 PFR Standard 3: Options development

Introduction
Following achievement of PFR Standards 1 and 2, the options for implementing PFR are set out. The possibilities are discussed with the end user and the most appropriate PFR measures are selected and specified for implementation.

Aim
PFR Standard 3 allows options for PFR to be identified and considered. These options shall reflect the outcomes from Standards 1 and 2, and PFR measures suitable for the property and specify the most suitable PFR measures for the property. The options for PFR will consider the use of:

- measures that restrict water entry to the building under defined conditions
- materials that are recoverable after water contact
- services, fixtures and fittings that are recoverable by their location and/or ability to resist water damage.

The design and specification will be based on the information provided by Standard 1 and 2, and the measures specified shall be selected impartially.

Requirements
1. An options appraisal of flood resilience measures shall be undertaken based on the information generated within Standards 1 and 2. These appraisals shall also evaluate costs and benefits of suitable approaches, end-user needs, operation and performance.
2. The appraisal of these options shall consider the lifetime maintenance and operation requirements of the measures specified.
3. Wherever possible and where relevant, specified PFR measures shall make use of products and processes that are compliant with a recognised industry standard and/or are warranted.
4. The preferred options shall be agreed and documented.
5. This specification shall be set out in drawings and/or written text and shall adequately describe the measures to be taken and their method of installation.
6. The output is the identification and specification of the most suitable PFR measures for the property. This information shall then be developed into a construction/installation plan, undertaken by the appropriate person before any works or installation commence.
6 PFR Standard 4: Construction

Introduction
The achievement of the specification outcomes depends on the construction activity and installation of PFR measures. Ultimately, the quality of construction will help to ensure that the PFR measures installed will deliver the levels of resistance and recoverability required to meet the needs of both the building(s) and end users. This will then provide confidence to the end user and those providing insurance and/or maintenance to the building(s).

Aim
PFR Standard 4 ensures that the construction works deliver the benefits anticipated from the specified PFR measures, which are as a result of PFR Standard 3 outcomes.

Requirements
1 The appropriate person shall deliver all the necessary works associated with the construction and installation of PFR measures.
2 Where subcontractors are used, the appropriate person shall retain overall responsibility for the works.
3 All necessary preliminary work, including drying out and decontamination where appropriate, shall be carried out before implementation of PFR measures. These works shall be carried out in accordance with the design and specification in PFR Standard 3, and shall take due note of the flood risk assessment (PFR Standard 1) and the survey (PFR Standard 2).
4 The construction work shall be undertaken in accordance with good practice, including relevant standards, guidance and legislation, and shall comply with the Construction (Design and Management) Regulations 2015 (CDM 2015).
5 All PFR measures shall be inspected during construction by an appropriate person (see Table 2.1).
7 PFR Standard 5: Commissioning and handover

Introduction

An important element of any construction project is commissioning and handover. These elements demonstrate that the construction activity undertaken, and the measures installed within the property deliver the levels of PFR required by the end user. It also sets out all operational and maintenance requirements of the PFR measures installed.

Aim

PFR Standard 5 ensures that the completed PFR construction work will operate effectively as designed, and that the end user has all relevant information and has been instructed in any deployment, operation and maintenance requirements.

Requirements

1. PFR measures shall be inspected during construction (PFR Standard 4) and on completion by an appropriate person (see Table 2.1) to ensure that the work meets the specification requirements of PFR Standard 3. The inspection shall be conducted in an objective and impartial manner.

2. Any products used that have an agreed in situ flood resistant test procedure shall be tested after their installation within the building(s) at the request of the end user. These tests shall be supervised by an appropriate person (see Table 2.1).

3. The appropriate person shall provide all relevant information on the PFR works, design, specification, and operation and maintenance requirements in a project file (ie a handover ‘pack’) to the end user.

4. Where PFR measures need to be deployed for flood events, a person shall be nominated and agreed to take responsibility for deploying the measures in the event of a flood warning. This person shall be referred to as the ‘nominated person’.

5. The appropriate person shall demonstrate the method of deployment of measures (where appropriate) to the nominated person and shall ensure that this person understands how to prepare for a flood.
8  PFR Standard 6: Operation and maintenance

Introduction

Properties with a defined flood risk are likely to remain at risk over time. It is possible for the level of risk to the property to increase due to factors such as climate change and urbanisation. To maintain a level of protection to a property, the PFR measures installed should be operated and maintained following the guidance provided in the handover pack.

Aim

PFR Standard 6 ensures that the completed PFR construction works are properly operated and maintained, and that any demountable measures are stored correctly. Note that the responsibilities and duties for operation and maintenance are defined as part of meeting the requirements of Standard 2.

Requirements

1 The appropriate person, in accordance with CDM 2015, shall provide an operation and maintenance plan to the end user at the point of handover (PFR Standard 6).
2 The nominated person shall ensure that the PFR measures remain operative by following the guidance provided in the handover pack.
3 In the event of a flood warning, the nominated person shall deploy any measures following guidance provided in the handover pack.
4 Any operation of the PFR measures shall be recorded and the information retained and kept securely as an appendage to the handover pack.
5 All maintenance work shall be recorded and kept securely as an appendage to the handover pack.
6 The PFR measures shall be reviewed periodically to ensure that they continue to meet the needs of the end user and that the nominated person can continue with their obligations.
7 After a flood event the PFR measures shall be fully checked and inspected by an appropriate person taking account of the information in the handover pack. Any necessary maintenance shall be commissioned.
9 Glossary

Appropriate person
One of the duty-holders described under CDM 2015. They should act in accordance with a relevant set of professional standards, carry appropriate professional indemnity insurance and can demonstrate the required levels of skills, knowledge and experience and, as defined in the regulations, have a construction-related or a flood and water management background (see Table 2.1).

This individual should have the necessary capabilities and resources, with right blend of skills, knowledge and experience, who understands their roles and responsibilities when carrying out work.

They shall always act impartially and without favouring any particular supplier of equipment, materials or services.

Construction Design and Management Regulations 2015 (CDM 2015)
UK health and safety policy covering all aspects of construction activity and designating specific actions to stakeholders.

Decontamination
The removal or neutralisation of potentially-harmful substances from an object or area.

Drying
The removal of moisture from a building or building materials.

End user
The occupier of the property who is likely to deploy, operate and maintain any PFR measures.

Event (flood)
The occurrence (at source) of a flood hazard (such as surface water, river flooding). This is often used in accordance with a probability of a flood occurring (eg 1 in 100 flood event – or one per cent annual chance of meeting or exceeding this level).

Flood defence
Infrastructure used to protect an area against floods such as floodwalls and embankments. Normally these are designed to a specific standard of protection.

Flood map for planning
A map for land-use planning and development purposes, showing what flood zone (under National Planning Policy Framework (MHCLG, 2019) definitions) a proposed development is in.

Flood recoverability
The use of materials, products and construction methods can be recovered after flooding, i.e. managing water entry.

Flood resilience
The combination of flood resilience and flood recoverability.

Flood resistance
The use of materials and approaches to safely keep water out of the property. This relates to water exclusion, i.e. keeping water out.

Flood risk
An expression of the combination of the flood probability (or likelihood) and the consequences of that flood event. The higher the likelihood and the greater the impact of flooding, the higher the level of flood risk.

Risk = Probability (or hazard) x Consequences (or impact).

Flood risk management
Means of mitigating flood risk.

Flood source
Where the flood water originates. This may be one, or a combination, of the following types of flooding:

- flooding from rivers (fluvial flooding)
- flooding from the sea (coastal flooding)
- groundwater flooding
- surface water flooding
- sewer flooding
- asset failure flooding (e.g. dam failure)
- compound flooding.

Frequency
The average rate of occurrence of an event (e.g. flood).

Hazard
The potential to produce harm.

Maintenance
The process of preserving the condition of products and measures on a regular basis (normally in line with a defined schedule).

Nominated person
Identified individual who has specific responsibilities for related tasks.

Operation
The use or deployment of PFR measures during a flood event.

Pathway
The route that flood water takes to reach a property.

Probability
The average chance that something could happen. Normally expressed as an annual probability.

Property flood resilience (PFR)
Flood resilience related to buildings within the curtilage of a property.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptor</td>
<td>The entity that may be harmed by a particular hazard (eg a person, property, or habitat). For example, in the event of heavy rainfall (source) floodwater may propagate across the flood plain (pathway) and inundate building (receptor) that may suffer material damage (the harm or consequence).</td>
</tr>
<tr>
<td>Recoverability</td>
<td>The use of materials, products and construction methods that prevent the internal fabric of the property from being unduly damaged by flood water and allow it to recover quickly after a flood.</td>
</tr>
<tr>
<td>Requirement</td>
<td>A step to meeting specified aspects of PFR.</td>
</tr>
<tr>
<td>Residual risk</td>
<td>Risks remaining after actions have been taken to mitigate flood risk.</td>
</tr>
<tr>
<td>Resilience</td>
<td>The capacity that people, groups or structures may possess to withstand or recover from emergencies.</td>
</tr>
<tr>
<td>Resistance</td>
<td>The use of materials and approaches to manage water entry into the property. This relates to water exclusion, ie keeping water out.</td>
</tr>
<tr>
<td>Return period</td>
<td>The average period of occurrence of an event. When applied to flooding it is normally expressed in years. Return period is the inverse of frequency.</td>
</tr>
<tr>
<td>Risk</td>
<td>See Flood risk.</td>
</tr>
<tr>
<td>Severity (of flood hazard)</td>
<td>The potential maximum impact level of a source (or combination of sources) of flooding at a specific location.</td>
</tr>
<tr>
<td>Source (flooding)</td>
<td>See Flood source.</td>
</tr>
<tr>
<td>Stage</td>
<td>The individual parts of the process of delivering PFR.</td>
</tr>
<tr>
<td>Subcontractor</td>
<td>The person or organisation responsible for delivery of part of the construction or installation works normally employed by the principal contractor as defined in CDM 2015.</td>
</tr>
<tr>
<td>Survey</td>
<td>An inspection and assessment of a building, land or water body, including other information sources, as part of the PFR process.</td>
</tr>
</tbody>
</table>
References


Statutes

The Construction (Design and Management) Regulations 2015 (No.51)
CIRIA members

ABG Geosynthetics Ltd
Active Building Centre
AECOM Ltd
AMC Environmental Ltd
Arcadis Consulting (UK) Ltd
ARL Training Services Ltd
Arup Group Ltd
Atkins Consultants Ltd
Autodesk Ltd
Balfour Beatty Civil Group
BAM Nuttall Ltd
Barratt Developments Plc
Black & Veatch Ltd
BSG Ecology
Buro Happold Engineers Ltd
BWB Consulting Ltd
City of Glasgow College
City University of London
Costain Ltd
COWI UK Ltd
Curtins Consulting
Darcy Products Ltd
Durham University
E3P
Environment Agency
Esri UK & Ireland
Galliford Try Plc
Gatwick Airport Ltd
Gavin & Doherty Geosolutions Ltd
Geobrugg AG (UK office)
Geotechnical Consulting Group
Glasgow Caledonian University
Golder Associates (UK) Ltd
Grosvenor Britain and Ireland
Heathrow Airport Ltd
Henderson Thomas Associates Ltd
Highways England
High Speed Two (HS2) Ltd
HR Wallingford Ltd
Hydro Water Management Solutions Ltd
Imperial College London
Institution of Civil Engineers
Ischebeck Titan Ltd (Ground Engineering Department)
J Murphy & Sons Ltd
Jacobs
James Fisher Testing Ltd

Kier Group plc
Laing O’Rourke Civil Engineering Ltd
London Underground Ltd
Loughborough University
Maccarferri Ltd
Marshalls Plc
Ministry of Justice
Mistras Group Ltd
Morgan Sindall Construction and Infrastructure Ltd
Mott MacDonald Group Ltd
Network Rail
Newcastle University
Northumbrian Water Ltd
OES Consulting Ltd
O’Keefe Group
Pinssar (Australia) Pty Ltd
Polypipe
Rail Safety and Standards Board
Royal HaskoningDHV Ltd
SafeLane Global Ltd
Sir Robert McAlpine Ltd
SLR Consulting Ltd
Smith and Williamson LLP
Southern Water Services Ltd
Stantec
Stuart Michael Associates
T&S Environmental Ltd
Temple Group Ltd
Thames Water Utilities Ltd
TOPCON (Great Britain) Ltd
Transport Scotland
UK Green Building Council
United Utilities Plc
University College London
University of Bristol
University of Cardiff
University of Edinburgh
University of Liverpool
University of Reading
University of Southampton
Wessex Archaeology
WSP
WYG Environmental
Zero Waste Scotland

November 2019
Property flood resilience (PFR) is an important part of the response to flood risk. PFR includes measures to reduce the risks to people and property, enabling households and businesses to reduce flood damage, speed up recovery and recoccupation. PFR measures should reduce the amount of water entering buildings (known as resistance measures), or limit the damage caused if water does enter a building (known as recoverability measures).

This code of practice (CoP) is concerned with PFR measures that can be introduced to buildings at risk from flooding. Often these measures can be installed as part of the repair of buildings after flooding has occurred. However, some property owners may wish to be proactive and fit measures in anticipation of a flood.

The CoP includes six standards that specify what should be achieved. These standards are supported by comprehensive guidance on how the standards should be met by following stages within a PFR delivery process. The guidance is provided in CIRIA C790B Code of practice and guidance for property flood resilience, which will be published in 2020.