Future-proofing New and Existing Buildings
Flood Resilient Design and Construction Techniques

Katy Hunter
BRE Scotland
28th April 2015
Introduction

– Who are BRE
– Flood Risk in the UK
– Retrofitting Flood Resilience
– New Build Flood Resilience
– Insurance Matters
– BRE Centre For Resilience
BRE
building a better world together
BRE making a positive difference in the built environment since 1921

Our vision: To make an unmistakeable imprint on a highly regarded built environment

We use cutting edge research...

Our mission: To build a better world together

...to develop products, services standards and qualifications

...to bring about positive change to the built environment.
BRE Trust

Profits made by the BRE Group fund new research and education programmes that helps us to meet our goal of 'building a better world together'.

www.bre.co.uk/bretrust
BREEAM
Our internationally recognised measure of a building's sustainability helps drive sustainable performance and value.

www.breeam.com
LPCB Certification
World leader in fire and security approvals and producer of the ‘Red Book’ – an essential reference for specifiers, regulators, designers and end users.

www.redbooklive.com
BRE Academy
Delivering high quality, world class training and education programmes - developed and delivered in partnership with BRE and industry experts.

www.bre.co.uk/academy
BRE Innovation Parks
Home to some of the world’s most sustainable buildings, landscape designs and low carbon products, materials and technologies.
ipark.bre.co.uk
Flood Risk in the UK

Flooding is one of the highest order risks for the built environment and is expected to be more frequent throughout the 21st Century.
Flood Risk in the UK

- **Northern Ireland**: up to 66,000 properties (7.5%)
- **Scotland**: 250,000 properties (10%)
- **England and Wales**: 5.2 million properties (4.5%)
- **UK total**: approximately 5.5 million

**Climate Change**

Urbanisation

Pluvial flood risk accounts for **one third** of all flood risk in the UK and controlling this risk alone could require investment of £150 million per year.

Insurance claims from the 2007 surface water floods (e.g. in Sheffield, Hull) outnumbered claims for river and sea flooding by 6:1.
Retrofitting Resilience

80% of the building stock in 2050 already exists today – how do we protect these properties from flooding?
Applying flood resilience technologies

- Types of flooding
- Flood risk management strategy (resistance or resilience)
- Different types of technologies
- Maintenance considerations
- Installation
The aim of the SMARTeST project was to improve the Road to Market for innovative Flood Resilient (FRe) technology. Four categories were considered:

**Perimeter Technologies**
To protect a community or group of buildings from flooding.

**Aperture Technologies**
Products to protect from flooding at a building level.

**Building Technologies**
Including waterproofing and water resistant coatings and sealants.

**Infrastructure Technologies**
Products to protect infrastructure from the scouring effects of flood water.
SMARTeST

– Perimeter and aperture technologies can be temporary, demountable or permanent – and can be activated manually (through human intervention) or automatically, by buoyancy or mechanical action.

– Some of these technologies can also be called Property Level Protection (PLP) – when installed at property level.
New Build Flood Resilience
Publications
Home Quality Mark
Research Activity
BRE Digest – Flood-Resilient Building (DG 523)

- Legislation and planning
- Flood-risk assessment
- Flood performance of buildings
  - Structural performance
  - Material performance
  - Impacts of contamination
- Building in flood-risk areas
- Designing flood-resilient buildings
  - Avoidance
  - Resistance
  - Resilience
- Sustainable development and flood risk.
Home Quality Mark

- The Home Quality Mark is a new rigorous standard for new homes.
- It provides consumers with the tools to make an informed choice when buying or renting a new home.
- Enables housebuilders to differentiate their products and to articulate the benefits of new homes.

Encouraging design decisions that will make your home more resilient to environmental damage, flood and wear and tear.
Flood Resilient Property – Construction

- Traditional brick and block masonry cavity walls, timber first floor and roof. Concrete slab and foundations – pile foundations where problematic soil conditions exist.

- The house is designed to resist water up to 600mm in depth after which water is allowed to enter into the property to reduce pressure on the structure.

- Automatic opening window panels (flood inlets) are triggered by localised sensors to allow a controlled inundation of flood water into the property.

- Flood resistant doors automatically protect against water entry.

- Internal walls are water resilient, using materials which will allow fast recovery: concrete block partitions, lime plaster or magnesium oxide board as finishing – skirting is sealed with an internal cavity membrane.
Wall to Floor Junction (Option A)

A primary and a secondary layer of waterproofing was designed:

- Water tanking below slab to resist water pressure (primary layer)
- Cavity drainage for water collection after flood (secondary layer)

Wall to Floor Junction (Option B)

Waterproof concrete utilised – again a primary and secondary layer of waterproofing was designed:

- Concrete slab and wall with water resistant additive (primary layer)
- Cavity drainage for water collection / removal following a flood (secondary layer)
- Full cavity insulation (closed cell / waterproof)
Flood Resilient Property – Services

- A Mechanical Ventilation Heat Recovery (MVHR) system is installed in addition to natural ventilation – this will aid drying out after a flood.

- All service entry points are sealed (or raised where possible / practical), plus all electrics and appliances are raised above the design flood level.

- Kitchen units below flood level are of waterproof material (plastic or stainless steel hardware). Kitchen unit doors and drawers are sealed.
**Sewerage**

- Sewage system has a non-return valve
- Drainage pipes are sealed through the “flood proof layer”
- Inspection chambers are fitted with anti-lift lid
- Drainage pipes are covered and locked in concrete to resist lower ground water pressure and prevent damage

**Post-flood drainage**

- Channels, pipes and drains are built into the floor
- Drain connections into man hole are fitted with non-return valve and anti-lift lid
- Pipes are fitted with non-return valves to avoid back-flow of sewage
Flood Resilient Property – Flood Warning and Sensors

- A series of water sensors are located outside the property and on entry points, linked to an internal remote alarm.
- Emergency rescue locations are designated at ground and first floor levels.
- Automation is essential to allow the various technologies to work in synergy and provide early warning, emergency contact and automatic safety measures.
- External door sensors and internal ground level sensor advises of the presence of water.
- All sensors are connected to a main sounder to give acoustic and visual warning.
- Potential to connect the main sounder to an automated call system / emergency authorities.
- Flood Emergency Kit to be stored on first floor.
Insurance Matters
Statement of Principles
Flood Re
Property Flood Resilience Database (PFR-d)
Statement of Principles – Government and insurance industry flood agreement

– An agreement between the ABI and the Government: Insurers committed to offer insurance to many previously flooded or at-risk customers in the UK.

– In each country in the UK, the national body with responsibility for flooding carries out flood risk assessments which insurers use to determine how the Statement of Principles is enforced.

– The agreement guarantees that insurers will:
  – renew existing customers’ home insurance if their property is not considered to be at significant risk of flooding
  – renew the home insurance of existing customers whose properties are considered to be at significant risk of flooding, as long as there are Government or agency led plans to reduce the flood risk in the area within five years
  – continue cover for the new owners of a previously flooded or at-risk property if the original customer decides to sell.
Flood Re

- Flood Re will be run and financed by insurers as a not-for-profit fund which will cover the cost of flood claims from high risk homes.

- Insurers will pass the flood risk element from high risk households to the fund. Premiums for the flood risk will be calculated based on council tax banding.

- Flood Re would charge member firms an annual fee of £180million. This equates to a levy of £10.50 on annual household premiums and represents the estimated level of cross-subsidy that already exists between lower and higher flood risk premiums.
Flood Insurance and Resilience

– Often householders, local authorities or Government take steps to improve the resilience of properties, through construction work or the installation of property level protection (PLP).

– The insurance industry is currently not able to take into account this investment as they have no data to refer to in order to assess the reduced risk.

– Anecdotal evidence suggests that some householders who have previously been flooded, or who are at risk of flooding have taken measures to protect their homes and yet still cannot insure their homes affordably.
Property Flood Resilience Database

- Project partners BRE, AXA Insurance and Lexis-Nexis are currently undertaking research that addresses this difficulty in accessing information on improvements to buildings which have been taken to manage flood risk.

- The Property Flood Resilience Database (PFR-d) project is funded by Innovate UK and will result in the means to inform insurers of property level resilience measures.

- The project has developed a database where flood resilience measures undertaken by householders, local authorities or Government can be logged.

- A framework for the database to be linked to insurers other datasets (e.g. flood risk) has been created.
Property Flood Resilience Database

The Database has been developed through:

– An initial review of the types of data that are currently collected in building level flood risk assessments and surveys

– Development of a ‘matrix’ of information we feel is necessary across resistance, resilience and community factors

– Each factor has a series of sub-factors, which are ranked depending on the automation, materials used, certification and testing procedures.

– Site surveys – to confirm the necessary factors for the matrix and establish a standardised procedure for surveyors to follow.
BRE Centre for Resilience
Using knowledge and research the centre will deliver improvements for the resilience capacity of the built environment.

www.bre.co.uk
BRE Centre For Resilience

What we do:
- Conduct research into new mitigation and adaption methods
- Create new standards for design, planning and products
- Test, trial, demonstrate and certify a new tranche of innovations
- Develop new training programmes for the sector
- Communicate and disseminate knowledge

Aims & objectives
- Plug the knowledge gaps on built environment resilience
- Use the data generated to create a new generation of built environment related standards, products and tools that promote resilience
- Build a better world in partnership with change making organisations
- Develop UK sector knowledge and innovation on achieving resilience that can be exported around the world
Resilient Built Environment Research Programme

- **Flood resilient homes – repair standards.** A project to develop appropriate standards for flood resilient repairs, and technical guidance to help contractors deliver cost-effective measures.

- **Wind loading on buildings.** More than 90% of building wind damage occurs at wind speeds below the basic design wind pressure – this project will address this serious performance gap.

- **Tackling overheating in urban dwellings.** This project will provide vital guidance and information based on hard scientific data, including a detailed review of the potential risk of flats to overheat.

- **Resilience to natural disasters.** Builds on the successful BRE Trust and IFRC (International Federation of Red Cross and Red Crescent Societies) funded work to develop the QSAND Tool for post disaster reconstruction/redevelopment projects.

- **Community resilience.** This will be a precursor to a wider project which aims to develop a tool for assessing and managing resilience at community level.
White Paper

- Details the extent of flood risk in the UK
- Flood resilience and insurance
- Flood resilient planning and construction
- Community flood resilience

- 6 conclusions and recommendations
Thank you for listening

Katy Hunter
BRE Scotland
hunterk@bre.co.uk
+44 (0) 1355 576 200