Resilience of the built environment

Dr Stephen Garvin – Director, BRE Centre for Resilience
BRE Trust Resilience Research Programme 2015-17

- BRE Trust consultations highlighted three major climatic impacts with associated gaps in existing knowledge – **flooding, wind and overheating** – these were the priority areas for this programme.

Also addressed were:
- QSAND Development
- Community Resilience (University of Brasilia)
- Energy Resilience
Resilience

– ‘the ability of assets, networks and systems to anticipate, absorb, adapt and / or rapidly recover from a disruptive event.’

– *Cabinet Office*

– Resilience means the built environment being better at preparing for and responding to the extreme weather events, natural disasters, man-made disaster, crime, terrorism, resource loss, fire, IT/cyber failures, ……
Resilience – the challenges

- Inefficient market responses lead to market failures
- Organisational failures and community incoherence
- Complex socio-technical interdependencies
  - Need to understand personal and corporate behaviours
- Knowledge gaps; products and services
  - Unproven responses and technologies
- Lack of standards
- Sudden shocks vs. long term change
  - Non-stationary risk statistics
Flood events (UK)

- In the last 10 years Insurers (ABI members) have paid around £6bn* in flood claims.
- Notable losses include:
  - 1998 Easter Floods – 4,200 properties flooded, £350m losses
  - 2000 Autumn Floods -10,000 properties flooded, £1bn losses
  - 2004 Boscastle -100 properties flooded
  - 2005 Carlisle –2,700 properties flooded, £400m losses
  - 2007 Summer Floods –61,000 properties flooded, £3bn losses
  - 2009 Cumbria –2,200 properties flooded
  - 2013/14 Winter Storms – 5,000 properties flooded, <£1bn losses
  - 2015/16 Winter Storms – Desmond, Eva and Frank - £1bn
Adaptation to flooding dry and wet-proofing

Adaptation by floating and amphibious homes, homes on piles

REF: Flood Mitigation Using Cascading Dike System
Nehlsen, E., Wilke, M., Goltermann, D., Pasche, E.
Property – Resistance and Resilience

- flood resistance
  - construction of a building in such a way as to prevent or minimise floodwater entering the building and damaging its fabric - use of low permeability materials.
- flood resilience
  - measures that can be incorporated into the building fabric and/or fixtures and fittings that can be installed, to reduce the consequences of flood water entering the property
    - Use of sacrificial materials for internal or external finishes, e.g. gypsum plasterboard placed so that it can easily be removed below the flooded level and replaced, or materials that can resist the effects of flooding, e.g. tiled finishes.
Property Flood Resilience: Demonstration – Victorian Terrace
Resistance

- Flood resistant doors
- Flood resistant windows
- Solid brick external walls with external render (2 coat proprietary system)
- Resistance design to 600 mm depth
- Controlled inundation to property beyond this depth
Floor

- Original concrete floor; 100 mm on ground
- Profiled drainage membrane
- Resilient insulation boards
- Screed membrane
- 50 mm self levelling concrete screed
- Ceramic tile finish, turned up walls by 150 mm, fully bedded in waterproof adhesive
Cavity drain membrane and sump pump

- Cavity drain membranes as internal barrier, wrapped around the walls, laid across the floor and sealed using adhesive
- Water drains to a sump pump
Walls

- Resistance and resilience

- Resistance: Cavity drainage membrane, drain and pump: groundwater and external water under force

- Resilience: membrane prevents wetting of wall, resilient plaster, resilient insulation and wall board finish; drying of cavity via ventilation or limited removal / replacement of boards and insulation
Resilient kitchen

- No MDF or chipboard components; or laminated or melamine surfaces
- Resilient composite material
- Ceramic work tops
- Tiled under units
Services

- Electrical: wiring hung from ceiling down walls
- Sockets located above flood level (800 mm, 1200 mm, 1500 mm)
- Water: non-return valves on toilets, kitchen supply / drainage
Resilient house on BBC Countryfile
Resilient house: expelling water quickly
The Flood-Repairable House

- Closed-cell insulation in cavity walls
- Wall-mounted TV, other valuable items on high shelves
- Electrical sockets above flood level
- Tiled floors, with waterproof adhesive and waterproof grout
- Sump/pump to remove water
- Kitchen units on legs, concealed by removable kickboards
- White goods on raised plinths
- Non-return valve in sewer pipe
- Rising butt hinges, for removable doors!
- Wall-mounted boiler and meters
- Sentimental items and important documents kept upstairs
- Separate heating and electrical circuit for upper floors
- Plasterboard laid horizontally
- Defra 2016, with BRE and UWE Practitioners Handbook

Adapted from original image courtesy of the Eastern Solent Coastal Partnership (www.escp.org.uk)
Property Flood Resilience Action Plan

Industry group constituted by Defra

- Task Group 4 Identified the need for independent surveyors to provide information to property owners about the installation of flood resilience measures
  - Training
  - Certification
  - Standards
Property Flood Resilience-database

– Innovate UK supported project (UFR Project)

– Project partners:
  • BRE
  • LexisNexis
  • AXA
  • Liverpool City Council

– The project intended to create a means for insurers to find the ‘missing piece of data’ which could help them provide more appropriate insurance cover to properties in high flood risk areas, or where properties have suffered repeat flooding events.

– The project has developed a database (PFR-d), on Property Level Protection and resilience of buildings, and a framework for the PFR-d to integrate with surveyors and insurers existing systems.
BRE Global (supported by BRE Centre for Resilience, BRE Academy training and RICS) has responded to the Action Plan and announces the Certification Scheme for Independent Property Flood Resilience Surveyors.

Will provide surveyors with skills and access to the Property Flood Resilience Database (PFR-d).
The overall aim of the project is to:

“develop a robust and authoritative Code of Practice (CoP) and consolidated guidance that provides a standardised approach for the delivery and management of property flood resilience (PFR).”

- Project team
- BRE
- University West of England
- Whitehouse Construction
- CIRIA (PM)
- Funders
- AVIVA, EA, Scottish Government, Welsh Government, NI DfI
Buro Happold: Resilience Framework Tool
# Flood Resilient Repair Project: Partnership

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