History of British homes
a story of resilience

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Content

- NHBC Foundation
- Homes through the decades – historical perspective
- A broad view of resilience
- Back to the future – twice
- Resilient homes – some observations
NHBC Foundation

- Set up in 2006
- To provide research, guidance and good practice for the house-building industry
- Re-investing NHBC surplus for benefit of homeowners & the industry
- £620k funding for this year
- Some projects specifically to support small firms
- Our work feeds into government policy and debate

Homes through the decades

- Mid 1800s-1918 Victorian/Edwardian
- 1919-1939 Between the wars
- 1945-1959 Post war recovery
- 1960-1979 Towers in the sky
- 1980-1999 Technology and society
- 2000-present Embracing sustainability
- The future Meeting tomorrow’s needs
History of British housing
many pockets of resilience

2000

Why housing can be resilient

1950s house 'born' with DNA determined by the standards of the time.

2016
Improved DNA

Life of home - coping with change
What do we want homes to be resilient to?

- **Climate change** – greater risk of flood, higher temperatures, storms
- **Lifestyle change** – changing pattern of use, different requirements, working from home
- **Demographic change** – changes in household size, age profile. Providing suitable homes for the future
- **Built-in obsolescence/underperformance/misuse** – problematic operation, maintenance or repair, risk to health
- **Negative psychological/social change** – poor design for community cohesion, risk of social problems/limited life chances
- **Policy/regulatory change** (with unintended consequences)
- **National/international change** – recession, austerity, shortages, energy costs/energy security, Brexit

Resilience of homes (in the round)… has always been a priority

Understanding and delivering the broader aspects of resilience has been the domain of reformers and many professionals
Back to the future 1
Air quality in homes - Mid 1800s

Edwin Chadwick
Links poor living conditions with poor health

Henry Roberts
Designs new Model homes for working families

Miasma

The story continues – 150 years later…. 

- Homes were draughty
- Major source of heat loss
- ‘Build tight ventilate right’
- Building Regs 2006: 10m³/hr/m²
- Building Regs 2010: 6m³/hr/m²

Airtightness requirement driven by low carbon agenda/policy and Approved Document L1A
Indoor air quality

Appropriate IAQ is the absence of air contaminants and pollution, such as:
- Combustion products
- Ozone
- Allergens including mould spores
- Chemicals and particles from building products and furnishings
- Cleaning products
- Tobacco smoke, cooking, hobbies, and pets
- Radon

Strong links with:
- Allergic and asthma symptoms
- Lung cancer
- Lung disease
- Airborne respiratory infections
- Cardiovascular disease
- ‘Sick building syndrome’

Emergence of MVHR
(mechanical ventilation with heat recovery)

A whole-house mechanical ventilation system
A design option adopted to reduce the energy demand of a home
Only works well if the home is very airtight

Built-in obsolescence/underperformance/misuse – problematic operation maintenance or repair risk to health
Policy/regulatory change (with unintended consequences)
Embedding resilience: reducing risk – MVHR

MVHR increasingly adopted → MVHR evaluated in research → New NHBC standards generated

Back to the future 2
Non-conventional construction
Fast forward 50 years - MMC debate

MMC today: a spectrum

Volumetric  Pod  Panelised  Sub-assemblies
MMC sub-assemblies

67% have used

- **Climate change** – greater risk of flood, higher temperatures, storms
- **Built-in obsolescence/underperformance/misuse** – problematic operation, maintenance or repair, risk to health
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MMC today – embedding resilience/verifying performance. NHBC model

- **Establish critical functions**
  - Structure
  - Fire
  - Weatherproofing
  - Durability
  - Thermal
  - Acoustic
  - Services
- **Determine performance**
  - Test evidence.
  - Compliance with Standards
- **Apply to the building**
  - Making sure that systems/components are tuned to meet specific local conditions

Compliance with Standards
Resilient homes: some observations

a) Energy efficiency – annual energy spend

<table>
<thead>
<tr>
<th>Type</th>
<th>Victorian</th>
<th>New build</th>
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<tbody>
<tr>
<td>4-bed detached</td>
<td>£2,460</td>
<td>£1,050</td>
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<tr>
<td>3-bed semi-detached</td>
<td>£1,670</td>
<td>£780</td>
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<tr>
<td>3-bed mid terrace</td>
<td>£1,430</td>
<td>£760</td>
</tr>
<tr>
<td>1-bed ground floor flat</td>
<td>£840</td>
<td>£500</td>
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<tr>
<td>Victorian</td>
<td>With some modern day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>improvements</td>
<td></td>
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<tr>
<td>New build</td>
<td>Built to 2013 Building</td>
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<tr>
<td></td>
<td>Regulations</td>
<td></td>
</tr>
</tbody>
</table>

Energy efficiency - design

- Rectangular detached
  - Form Factor 2.5
  - 4,111 kWh/yr

- L-shaped detached
  - Form Factor 2.7
  - 4,395 kWh/yr
### Energy efficiency - use

<table>
<thead>
<tr>
<th>Ventilation</th>
<th>Heat pumps</th>
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<tbody>
<tr>
<td>1 Natural</td>
<td>6 Air source</td>
</tr>
<tr>
<td>2 Mechanical</td>
<td>7 Ground source</td>
</tr>
<tr>
<td>3 Mechanical</td>
<td></td>
</tr>
<tr>
<td>with heat</td>
<td></td>
</tr>
<tr>
<td>4 Solar PV</td>
<td>8 Single zone</td>
</tr>
<tr>
<td>5 Solar thermal</td>
<td>9 Multiple zone</td>
</tr>
</tbody>
</table>

### Key

1. Central fan unit with heat exchanger
2. Boost switch
3. Extract grille
4. Supply grille
5. Ducting
b) Resilience of fabric – exteriors


c) Resilient to overheating


d) Resilient to changing needs of occupants

Emerging smarter features, for example:

- Low occupancy setback
- Proactive transport applications
- Occupant-sensing security
- Advanced telecare
- Low voltage DC circuits
Connectivity: future-proofing new homes

In order of priority:

1. Make sure router can be located centrally within the home
2. Provide one single extra data cable to allow future expansion of the network
3. Provide wired connection to main TV
4. Provide further wired connections to principal rooms

Projects referred to
NHBCFoundation.org