# BIM4Housing's Expert's Recommendations on Mitigating Risk to Dry-Wet Riser, while Strengthening the Golden Thread

**(In their own words with edits)**

**Second Edition**

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**And the experts listed in Appendix 2**

*Below are recommendations that we, as BIM4Housing, are putting forward as the findings of our subject matter experts. We do not claim these findings to be definitive, but we would hope that they would provide 'accountable' and 'responsible' persons with some of the detail they would require to ensure that risks are mitigated.*

## Format

The structure of this set of information is designed to be consumed in various ways by different stakeholder groups doing different things. Therefore, information mentioned in one section may be repeated in another, so they can be applied to a particular activity.

Also, we have sought to organize the information to make it more machine-readable so, although the lists could be reduced by combining similar items, this would make them less easily used in applications.

Despite the need to edit and contextualise, we have tried to retain the authentic voice of our experts throughout. This is especially so in the Appendices, where no colloquialism is left unturned.

## Terms of use

This document is not intended as an end-result, but as a snapshot of a dynamic, on-going piece of work being developed by Subject Matter Experts who represent the different interest groups.

We hope it is helpful, but it should not be used in isolation, since, as we have learned from our collaboration, no one knows everything- and experts often disagree. It should therefore be used to supplement other sources of information, all of which should be validated by a responsible person applying it to a project.

Comments and additional contributions are welcome, and a panel of volunteer experts will review suggestions to assess/validate them and augment our recommendations as required.

This document can be viewed, downloaded, and commented upon at https://bim4housing-blackbox.com/publications/

# INTRODUCTION

## BIM4Housing Structure

We have six Working Groups of experts who understand the individual Stakeholder needs of Development, Design, Construction, Manufacturing, Operations, and the specialist Advisors who support the whole process. Each Working Group determines the problems they are experiencing that could be alleviated by better information, often from a different Stakeholder group and they collectively establish Workstreams to collaborate and share knowledge to come up with practical solutions.

They have established Workstreams for MMC, Data Standardisation, Sustainability and Fire Safety and the latter has, in turn, established Round Table workshops that bring together SMEs who really understand specific asset types.

(See Appendix 1 for Structure Diagram)

## Fire Safety Methodology

In 2021 it was determined to take individual fire-critical assets and examine impacts and influences through their lifecycle. A series of online discussions were held, along with one-on-one calls and an email gathering of views and inputs. In 2022 this consultation culminated in a series of Roundtable discussions, each with a clear focus and targeted output. BIM4Housing's expert team was enhanced by guests from the GTI, along with other fire safety specialists throughout the process.

Phase 1 defined the over-arching questions that need to be answered, for each asset type, to deliver the BIM-plus solution necessary to the effective functioning of the Golden Thread in terms of Fire Safety.

The questions defined are:

- What risks does the asset mitigate?
- To what risks is the asset, itself, susceptible?
- What information is needed about an asset, to ensure it performs as required?
- What tasks/method statements/procedures are required to ensure the asset is installed, commissioned, inspected, and maintained properly?
- What level of competency/training needs to be in place?
- How should product changes be recorded?

Phase 2 sought to answer those questions, offering a set of recommendations to mitigate risk and to help to deliver The Golden Thread, through the effective management of required information.

Phase 3 saw the Recommendations published on the BIM4Housing Blackbox web site enabling further comment and input to enhance the document.

Phase 4 saw a second tranche of roundtables, which sought to update the Recommendations in the light of the Fire and Building Safety Acts and other industry changes. This Second Edition is the result.

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# Dry-Wet Riser Methodology

The output from a Roundtable (20th September 2021) was collated and contextualized and combined with further subject matter expert input. Significant participant engagement was achieved prior to the event. The resulting report was then peer-reviewed.

Now, eighteen months on, we are reviewing the Recommendations in light of recent legislation and any change in industry practice.

## What is a Dry-Wet Riser?

A **dry riser** is a normally empty pipe that can be externally connected by firefighters to a pressurised water source. It is a vertical pipe intended to distribute water to multiple levels of a building or structure as a component of the fire suppression systems.

Most buildings have a "dry riser" or "wet standpipe" system where the pipes are kept full of water for manual or automatic fire fighting operations. Dry risers are used when the water pressure of a building wouldn't be enough for fire suppression and in unheated buildings where the pipes could freeze. In the UK, dry risers must allow fire engine access within 18 m of the dry riser inlet box. Dry risers in occupied buildings must be within a fire-resistant shaft, usually one of a building's fire escape staircase enclosures. The riser is also where the gauges, valves, and alarm devices are located.

Most buildings have Dry Risers.
The only buildings that have wet risers are +50m.
They are required in buildings over 18m in height as part of firefighting shaft provision or where a pumping appliance has not been provided to within 45m of all points inside each flat measured along the route of the hose. Section 13: 13.2 a & b

BS 9990 provides guidance that the run of horizontal connecting pipe is a maximum of 18m in length.

Depending on regional nomenclature, the term "dry riser" may refer to a standpipe, intended to provide water to fire hose connections, or a vertical main pipe in an automatic dry pipe fire sprinkler system. A dry standpipe has an external fire department connection at ground level, such as a Storz coupling, through which water can be pumped from the fire engine pump to the fire hose attachments on each floor. A dry pipe fire sprinkler system is a network of pipes connected to fixed sprinklers inside a building, which is full of air until one of the sprinklers is triggered.

**Wet risers** are used to supply water within buildings for firefighting purposes. The provision of a built-in water distribution system means that firefighters do not need to create their own distribution system in order to fight a fire and avoids the breaching of fire compartments by running hose lines between them.

Wet risers are permanently charged with water. This is as opposed to dry risers which do not contain water when they are not being used but are charged with water by fire service pumping appliances when necessary.

Part B of the building regulations (Fire Safety) requires that fire mains are provided in all buildings that are more than 18 m tall. In buildings less than 50 m tall, either a wet riser or dry riser fire main can be provided. However, where a building extends to more than 50 m above the rescue service vehicle access level, wet risers are necessary as the pumping pressure required to charge the riser is higher than can be provided by a fire service appliance, and to ensure an immediate supply of water is available at high level.

Wet risers are charged with water from a pressurised supply, often pumped from a storage tank, with landing valves at specified locations on each floor.

It should be possible for fire service pumping appliances to supplement the supply to wet risers in the event of an emergency, such as storage tanks running low during long events. Pumping appliances should be able to access '…within 18 m and within sight of, a suitable entrance giving access to the main and in sight of the inlet.'

Generally, a wet riser supply system should be capable of maintaining a minimum running pressure at top outlet at roof level of 4 bar at a flow rate of 22.7l/s. the maximum running pressure permitted with only one outlet in operation is 5 bar.

Wet risers should be within fire-fighting shafts, and where necessary in protected escape stairs. Wet riser outlets, or 'landing valves' may be within in protected lobbies, stairs or enclosures where these are available.

Wet risers should be inspected and tested regularly to ensure equipment is functioning correctly and ready for use. Problems can be very serious in the event of a fire, and are typically caused by vandalism or theft, blockages or pipework failure or by connection failure or outlets being open.

## FINDINGS

*It was determined to look to 'codify' risks to enable teams to coalesce around tackling a problem, run scenarios to simulate what might happen and how collaboration can reduce the risk of them happening.*

*Clearly, it is not desirable for the 'Accountable Person' to be absolved of responsibility for not anticipating a risk, simply because it was not on this list of suggested risks- which should be considered a 'steer' not an absolute. However, without a list, it becomes impossible to define and deliver the information needed.*

### What are the component elements of a Dry or Wet Riser system?

a) Pipework Materials and fittings
b) Pipework Supports
c) Valve types including breeching, landing, air release, pressure regulators
d) Primary Electric Pumps
e) Secondary Diesel/Electric Pumps
f) Drain down pipework/valves
g) In let Boxes/Outlet boxes/cabinets
h) Locks and Keys
i) Level alarms for the water tank
j) Cabinet / inlet boxes door hinges

### Are there any dependencies on other systems?

a) Generator systems
b) Automatic Transfer Switches for electrical supply
c) Fire Alarm / interfaces
d) Sump and drain systems
e) Ventilation for diesel pumps (Combustion / Fresh air)
f) Water supply
g) Fire Fighting Shaft outlet location and compartmentation

### Q1a. What risks does a Dry or Wet Riser system mitigate?

a) Fire growth
b) Fire temperature
c) Structural failure due to extreme temperatures
d) Property loss
e) Loss of life for persons in and around the property
f) Loss of fire services attendees' lives
g) Spread of fire between buildings
h) Integrity of compartmentation within a building
i) Delays in deployment of firefighting media
j) Physical over-exertion of firefighters
k) Lack of firefighting appliance accessibility, external design, hard-standings, turning heads etc.

### Q 1b. To what risks are Dry or Wet Riser systems susceptible?

a) Wrongly placed outlets or inlets

b) Vandalism
c) Incorrect hydraulic calculations
d) Undersized drainage systems for drain downs, i.e., floods the plant room. (Wet risers only)
e) Undersized power suppliers and /or generators for Star Delta start of motors/pumps
f) Undersized power suppliers and / or generators for rotor locks
g) Diesel pump ventilation system incorrectly sized or flue arrangement failure
h) Battery failure on the diesel pump
i) Poorly maintained alarm valves, pumps, control panels
j) Poorly maintained fire alarm interfaces
k) Incorrect power supply fuses and ratings
l) Wrong compartmentation of the outlet riser cupboard within the FFL shaft - horizontal and vertical Door being opened and compromises its fire integrity)
m) Pumps manually switch off
n) Not being operational during the construction phase
o) Poor water quality including Legionella risks

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## Q2. What information is needed about Dry or Wet Riser systems to ensure they perform as required?

*It is important to understand how the information will be used and how the context will vary what information is required. Initially, this was the subject of quite a lot of debate – largely driven by a worry about 'information overload'. However, with a truly cross disciplinary team of SMEs, it was possible to drill down to understand the detail of why a role would need certain information.*

*The aim was to collect all the information all stakeholders need against all products and leave it to each role to configure their software applications to see only the information they need for that individual task.*

a) Location (inc x,y,z)
b) Pump Manufacturer
c) Pump Model number
d) Installer
e) Installation date
f) Warranty
g) Time delays inherent in the design
h) Size of the water supply tank
i) Designed operational duration in fire conditions
j) Minimum Flow rates design and achieved in commissioning
k) Pressure design and achieved in commissioning
l) Schematic
m) Replacement strategy
n) Location of connection points and drain down points
o) Zones protected
p) Drop Drainage capacity (so the room does not flood)

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## Q3. What tasks are required to ensure Dry or Wet Riser systems are installed, commissioned, inspected, and maintained properly?

*It should be a given that any work on fire safety critical assets should always be undertaken by competent people, probably 3rd party accredited. However, that person must be supported with any information that they might need to reduce the risk of an important step being missed and to provide an auditable record of what tasks were completed. This is common practice in M&E maintenance, where the industry has developed a significant library of standard procedures and tasks lists, along with roles/competency required.*

*An air-conditioning unit is maintained by a qualified air conditioning engineer, but the engineer is also issued with a check list for them to record what was done.*

*A similar industry-wide check list for installation, commissioning, handover, maintenance, and recycling could be agreed.*

### Installed:

The current British Standard used for design, installation, testing and maintenance of Wet and Dry risers is BS9990:2015 Non-automatic fire-fighting systems in buildings Code of practice with Approved Document B (Fire Safety) of the Building Regulations (England & Wales) stating the requirement of wet or dry depending on the height of the building.

Fire mains should be tested at appropriate stages during installation, as work progresses, and upon final completion. Records should be kept of the tests and their results.

### Commissioned:

Static pressure tests are required for both types of system. For wet mains a flow and pressure test is also required.

Prior to conducting tests, water should be allowed to flow through the fire main and be discharged via the topmost outlet to flush out any debris that might be present. Facilities should be provided for flushing out at the base of the main debris which is too large to be flushed to the top of the building.

While BS 9990 requires only that the system be pressure tested it is BAFSA's view of industry best practice that all Wet and Dry systems should initially be static pressure tested to at least one and half times the system's predicted maximum operating pressure for at least one hour.

Pumps and standby pumps should be tested, to include a test to determine if it will operate satisfactorily in the event of failure of the duty pump / power failure.

A permanent record of all initial inspections and acceptance tests should be kept by the responsible person. This should record:

a) date and time of inspection or test.
b) person carrying out the test.
c) test results noted.
d) any external factors significantly affecting the results (e.g., weather conditions).
e) follow-up action required.
f) work carried out as a result of e) with date, time, and result of retest

### Inspected and Maintained:

Maintenance frequency and procedures should be in accordance with BS 9991 or BS 9999 as appropriate.

All dry fire mains should be checked every six months to ensure that all valves are fully serviceable, and a wet pressure test should be carried out annually to ensure that there is no leakage.

Wet fire mains should be similarly checked, and, in addition, the water storage tanks and booster pumps should be checked for operational serviceability.

Defects in equipment should be rectified as soon as possible by a competent person and if delay ensues, the fire service should be warned, and warning notices should be posted in the building at the appropriate place.

Dry risers should be static pressure tested annually.

Wet risers should be pressure tested and flow rate tested annually as well as:

a) internal cleanliness, condition, and water level of storage tanks, including the operation of float valves and any water level alarms
b) booster pumps and their associated mechanical and electrical equipment
c) electrical supplies and equipment to prevent freezing
d) operation of system monitoring and alarms

Where pressure regulating valves are installed, the manufacturer's maintenance recommendations should be followed.

There should be a signed and dated log of periodic inspections, maintenance and rectification of any defects, which should record:

a) date and time of inspection or test
b) person carrying out the test
c) installation being inspected or tested
d) result of the inspection or test
e) any rectifications carried out or needed

The responsible person for the premises should complete routine periodic visual inspections of all fire main inlet and landing valves to ensure that they have not been subjected to vandalism or damage, and to ensure that all inlet and landing valve boxes and/or riser cupboards are suitably secure and clear of storage or debris. The frequency of this visual inspection should be determined by the responsible person as part of the building fire safety management strategy and/or fire risk assessment.

For example, industry-standard maintenance instructions – extract from BESA's SFG20.

Tasks

| | Code | Task | Action |
|---|---|---|---|
| ⌄ | 23256.00.T1 | Inlet and landing boxes | Check all valves open and close (leave closed and strap and lock).<br><br>Replace all instantaneous outlet washers.<br><br>Replace all damaged or missing blank caps and chains.<br><br>Check all handwheels and nuts are undamaged and in place.<br><br>Check landing instantaneous outlets are free moving and undamaged.<br><br>Check air release valve and replace if necessary.<br><br>Check inlet cabinet and door for corrosion.<br><br>Check inlet breeching valve springs and rubbers are free moving and in good condition.<br><br>Check glazing in door.<br><br>Remove any rubbish from the inlet box.<br><br>Lightly lubricate all moving parts.<br><br>Check:<br>1. inlets;<br>2. landing valves;<br>3. drain valves;<br>4. door hinges;<br>5. locking arrangements.<br><br>Report any defects. |

It is recommended that the following tests are carried out annually as detailed in BS 9990: 2015: The following will be inspected, which should also be carried out every six months:

- Inlet valves
- Outlet valves
- Drain valves
- Door hinges
- Locking arrangements to the inlet cabinets
- Inlet cabinets to confirm that there are no obstructions

a) Special attention should be given to all valves, spindles, glands, and washers to ensure that they are ready for immediate use.
b) If any leaks are identified, corrective action should be taken, and the system tested again.

c) Water should be passed through the system under pressure and readings taken of the flows and pressure.
d) The test should be carried out at the highest or furthest landing valve using the system pumps.
e) The Pump manufacturer recommends that the wet riser pumps are rotated weekly using the initiation panel to maintain readiness to fight fire in an emergency.

#### 7.4.3.2 Dry fire mains

For dry fire mains, the tests in **7.3.1.3** and **7.4.3.1** should be carried out annually.

#### 7.4.3.3 Wet fire mains

For wet fire mains, the tests in **7.3.1.3**, **7.3.1.4**, **7.3.1.5** and **7.4.3.1**, and the following checks, should be carried out annually:

a) internal cleanliness, condition and water level of storage tanks, including the operation of float valves and any water level alarms;
b) booster pumps and their associated mechanical and electrical equipment;
c) electrical supplies and equipment to prevent freezing;
d) operation of system monitoring and alarms.

Where pressure regulating valves are installed, the manufacturer's maintenance recommendations should be followed.

Fire Safety (England) Regulations 2022 require that all firefighting equipment provided for firefighters in buildings over 18m or 7 stories or more are subject to a monthly visual inspection.

The guidance says the checks can be visual or 'other' check but it is not the intention of the regulations to require the responsible person to engage specialists to undertake these checks.

## Q4. What level of competency/training needs to be in place?

*Industry training courses are vital, but they must be complemented by additional knowledge-transfer from people with many years real experience.*

*Individual manufacturers have product-specific training which complements the more general training. Such training resources need to be provided in all cases where a product is used – both for new build but also as part of the long-term H&S/O&M information, ideally held as machine-readable data in the Asset information model to ensure maintenance teams have easy access to critical information.*

BS 9990:205 requires competent persons to install and maintain with competence defined as:

competent person: person, suitably trained and qualified by knowledge and practical experience, and provided with the necessary instructions, to enable the required task(s) to be carried out correctly.

BSI Flex 8670 focuses on the competence of individuals and expects that organisations use this core criteria as part of their management of competency (planning, monitoring, reviewing etc.). This also enables the capture of the skills, knowledge, experience, and behaviors necessary to the undertaking of a defined role, function, activity, or task.

Commissioning and maintenance training:

a) BAFE operate a Scheme called BAFE SP105 which covers Dry and Wet Riser/Falling Installations. This Scheme exists to deliver independent evidence that providers are competent to deliver quality service and maintenance works for your dry riser or wet riser/falling installations. The training is delivered by UKAS Accredited Certification Bodies (licensed by BAFE)

b) Installer should have manufacturer-led product-specific installation training, in addition to any formal UKAS accreditation

c) Manufacturers should offer installation training, either in their own right, or sub-contracted out to a specialist to provide that service

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## Q5. How are the changes from one product to another recorded?

*Robust Change Management requires an information baseline against which the different states – current, proposed, final and ongoing change – can be measured and reported.*

*The baseline information should contain the required performance in a machine-readable/actionable form and the Change Management process should enable that to be compared with:*

*a) the actual performance of the designed solution (probably generic)*
*b) the performance of the chosen product against the generic*
*c) the performance of an alternative (value engineered?) product.*
*d) the record of what was used/installed.*

### Requirements and Suggestions

a) A schedule of safety critical elements for the building, to include products specified

b) This schedule would be "Locked" at a specific design stage, after which changes to products specified should not occur except for exceptional reasons

c) Baseline against which to compare proposed alternative products (Some designers have expressed reluctance to propose (not specify) a specific manufactured product that will satisfy their design due to liability, procurement rules and fees)

d) A formal change management system is required to ensure that any unavoidable changes are validated by a 'responsible' person e.g., original designer and/or fire engineer

e) There is a well-established change management process in construction called Technical Submissions in which requested changes from the specifications/recommendations, that were created by the designers (and selected manufacturers), need to be formally reviewed and approved. Design-and-Build procurement has affected that process and it should be reestablished in a way that the performance of a proposed product, and its constituent components, is easily compared with the proposed alternative and, if agreed, it is recorded as a Technical Deviation

f) Validation of changes would include verifying that the new product met all the requirements for the application with no detriment to the overall design, the details of which should be recorded (Changes in the product may be made between design and procurement, procurement and installation, handover, and ongoing maintenance)

g) More onus needs to be put on the client to ensure collation of Information Requirements and the updating of design models into 'as installed' content suitable for Asset/Facilities Management. Compliance systems should be informed with the information from the AIM

h) Full Disclosure of the product is needed at handover so that after Work Stage 7, if a manufacturer goes out of business or products change the record is there in perpetuity

i) Asset database must be kept up to date with core data for new installs. Installation documents should be held in a centralised digital location. Once BIM/COBie level data is manageable within the asset management system then this will be used as the main source of data. . Asset tagging (barcode) systems and processes should be considered as forming part of the change management process

j) Procurement should be included in the process, recording what was purchased and feeding that into the BIM process to locate where they were installed, or which products they are replacing

k) BIM, CAFM, Asset and Housing management systems must inform the change management process. The asset information needs to enable comparison but the original performance spec of the dry or wet riser and the related information such as Fire Strategy and Cause and Effect should form part of that Technical Deviation process. The FMs must be able to update the Asset Information Model with machine-readable data of the newly installed product

l) H&S files for each building (cradle to grave) must be supplied, recorded and be updated with notification of changes and the implications

m) Warranty information of the existing and the proposed products should be provided to allow proper consideration to be made on the selection of an alternative or replacement. If a product has a shorter life than another, this information should be available to inform selection. Given some of the products will be in locations that are difficult to locate, the longevity of a product could have safety implications

n) Specification or design brief for the business (performance and or product) should be recorded in a machine-readable format to enable validation against the Golden Thread

o) Recording who has worked on/replaced the component and their entitlement/competence to do so

p) Evidence that the component's performance in relation to the part it plays in the system has been considered and is warranted

q) https://www.gov.uk/government/publications/fire-safety-england-regulations-2022/fact-sheet-lifts-and-essential-fire-fighting-equipment-regulation-7

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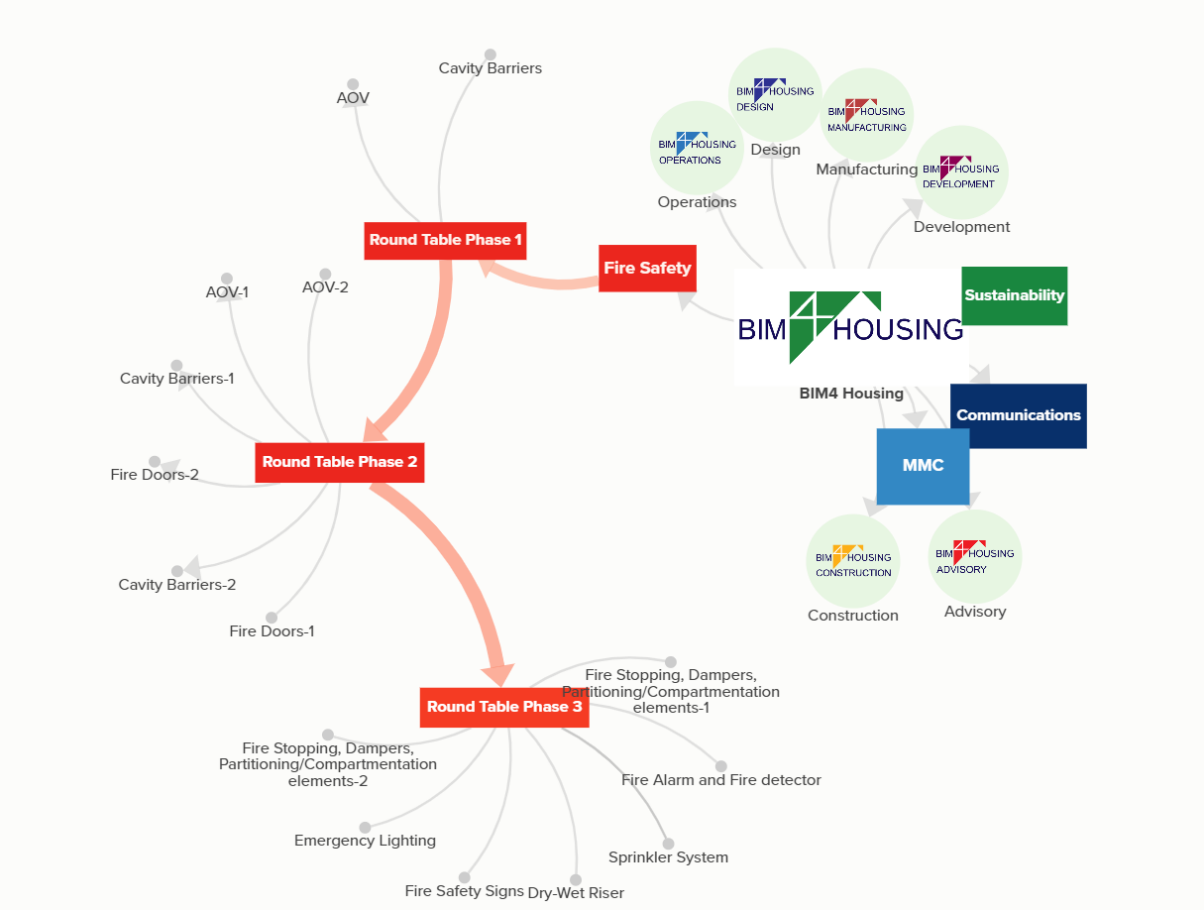
# APPENDIX 1

## BIM4Housing Structure



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# APPENDIX 2

## Participants

| | |
|---|---|
| Adam Sanders | RiskBase |
| Alan Brinson | Eurosprinkler |
| Andy Bell | Bell-Lancaster |
| Colin Crapper | Oxford City Council |
| David Leslie | Tower Hamlets Council |
| David Peacock | TÜV SÜD |
| George Stevenson | ActivePlan |
| Hilton Nyazamba | The Barnet Group Ltd |
| Ian Smith | Select-Consult |
| Joanna Harris | Sodexo |
| Mo Fisher | PRP |
| Paul Bray | Plymouth Community Homes |
| Paul McSoley | Mace |
| Paul Oakley | ActivePlan |
| Paul Wooldridge | Haringey |
| Pauline Tuitt | L&Q |
| Sarah Stevenson-Jones | Swan Housing |