

# Digital innovation in construction and asset management

## Speakers

**Dr Gemma Burgess**, acting director Cambridge Centre for Housing and Planning Research, University of Cambridge

**Yusuf Muhammad**, co-founder and design director, Plumis

**Julia Valentine**, director, Kreo

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# How can digital technologies change the way we plan, build and maintain homes. ?

Dr Gemma Burgess

# CCHPR

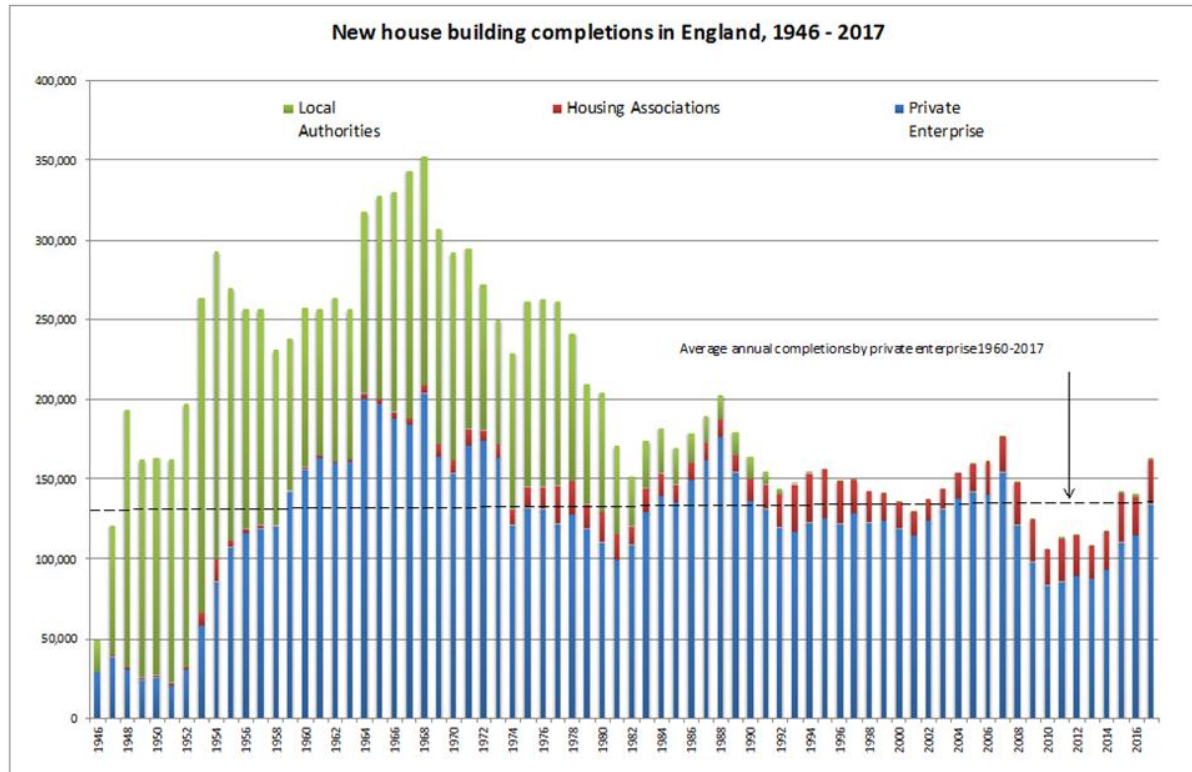
- The Cambridge Centre for Housing and Planning Research  
University of Cambridge Department of Land Economy
- Centre for Digital Built Britain - partnership between the  
Department of Business, Energy & Industrial Strategy and the  
University of Cambridge
- Construction Innovation Hub
- Deliver a smart digital economy for infrastructure and  
construction for the future and transform the UK construction  
industry's approach to the way we plan, build, maintain and use  
our social and economic infrastructure

## Housing in a DBB

- Housing sits at the heart of many wider social issues, and it will sit at the heart of the development of a Digital Built Britain (DBB)
- Delivering DBB is not simply about technological solutions to make supply and maintenance more efficient, although this is important
- Also about understanding how those solutions and efficiency gains interact with wider social policy issues to address UK housing inequalities

# UK housing crisis – supply?

- Lack of supply
- Few house builders
- Lack of innovation



## Industry challenges

- Farmer's 2016 review of the UK construction labour model was dramatically titled Modernise or Die: Time to decide the industry's future
- Low productivity
- Not embracing the potential of technology
- Problems of future workforce capacity, ageing workforce, low level of new entrants, deep and recurring recessions
- Lack of collaboration and improvement culture, which prevents organisations from scaling up, sharing risks and creating more business plan certainty
- Lack of R&D and investment in innovation

## Off-site housing construction

- Digitisation and off-site manufacturing might offer solutions
- House of Lords - emerging digital technologies have the potential to transform off-site into a more viable alternative to on-site construction (2018)
- Government presumption in favour of off-site manufacturing
- Includes:
  - Volumetric construction
  - Pods
  - Panelised systems
  - Sub-assemblies and components

## Potential benefits?

- To build at scale, at speed, sustainable, future-proofed
- Faster build programme
- Fewer defects, higher quality
- Easier to ensure buildings meet quality assurance standards
- Address the skills shortage
- Fewer labourers and increased productivity
- Cost advantages from economies of scale
- Improved health and safety
- Reduced disruption to the local community
- Improved sustainability
- Creating more regional jobs away from large conurbations

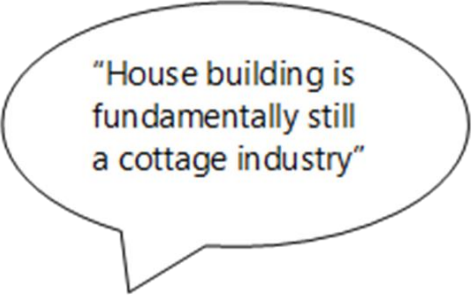


## Evidence of benefits?

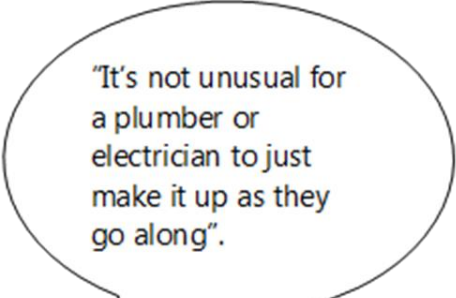
- National Audit Office (2005) suggested that using modern methods of construction should make it possible to build up to four times as many homes with the same on-site labour, and that on-site construction time can be reduced by over a half
- New entrants into the market – but early days
- Data on impact and evidence of benefits is limited
- Failure to capture learning from successful innovations

## Constraints


- Public attitudes
- Cost is a barrier to uptake - risk
- Build cost is only proportion of costs
- Current house builder business models
- Confidence innovation will be commercially rewarding
- Nature of construction procurement restricts collaboration between client and supply chain
- Land supply, the planning system, NIMBY-ism
- Reduce incentives to invest in innovation



"House building is fundamentally still a cottage industry"



"It's not unusual for a plumber or electrician to just make it up as they go along".



"The technology is there, but it is the investment of time that is the problem."

## UK housing crisis – management and maintenance?

- Expansion PRS, only 24% of the stock was built after 1980
- Age disparities affect quality, security and energy efficiency
- Raises management and maintenance issues
- Third of PRS homes considered non-decent (DCLG, 2017)
- Impact on safety
- Across the UK, 470 buildings are using the aluminium cladding responsible for the Grenfell fire
- Impacts health and well-being: 15 million people in the UK live in poor housing
- Cost : poor housing conditions are the source of 70% of NHS costs (NHBC, 2018)

## Challenges in governance and maintenance

- Lack of regulation
- Lack of incentives
- Lack of means and technology
- Lack of data

## OSM and asset management

- Benefits of offsite and BIM for asset management?
- Impact on long term management and maintenance?
- Digitally enabled OSM, BIM, DFM
- Building Information Modelling (BIM) - throughout the building life-cycle, from construction to facilities management
- 3D model-based process - tools to more efficiently plan, design, construct and manage buildings and infrastructure, to:
  - automatically generate inspection plans
  - digital life-cycle scenarios
  - share better-informed data with different stakeholders involved in order to reduce costs and risks
  - transform management capabilities
  - reduce costs involved in managing the asset

## Benefits?

- “Golden thread of building information” (Hackitt review, 2018)
- All safety-related information is gathered throughout the building life cycle
- Address the fragmentation of stakeholder’s activities and responsibilities, as well as the burden of excessive documentation
- Might help to save 5% in the construction cost (Hackitt review)
- Reduce repair and maintenance costs

# Challenges

- Evidence and quantification of benefits?
- Challenge of retrofit and existing stock
- Research on “human barriers”
- Issues of data ethics, privacy and security of access
- Governance challenges and attribution of responsibility

## Current research

- Housing stock represents 80% of the total built floor space in England
- By value, housing represents 35% of all new construction work, and 53% of all repair and maintenance work
- NHBC pays out £85m pa to rectify defects in new build homes
- There is therefore significant value that could be realised if digital uptake was improved
- Research on the socio-economic inhibitors to the take up of digital innovation in construction
- Construction Innovation Hub



**Cambridge** Centre  
for Housing &  
Planning Research

<http://www.cchpr.landecon.cam.ac.uk/>

[glb36@cam.ac.uk](mailto:glb36@cam.ac.uk)

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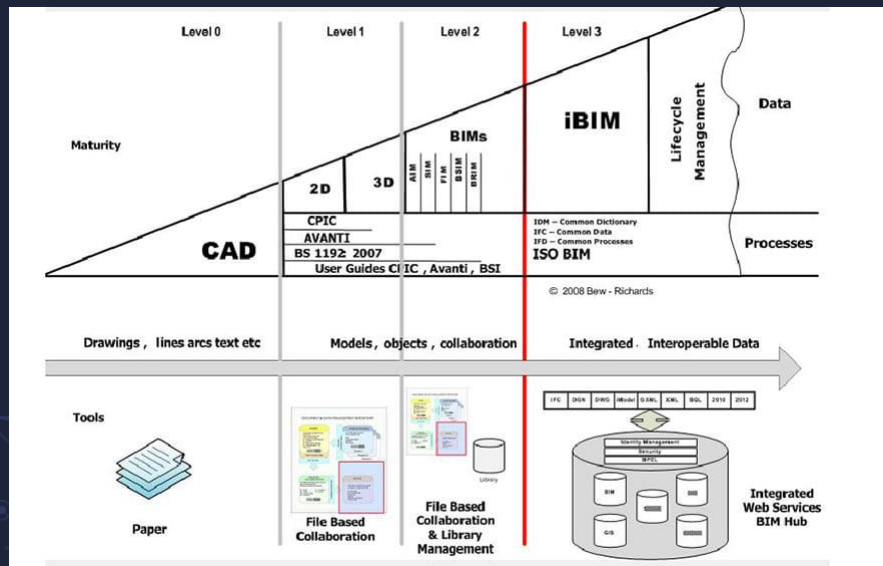


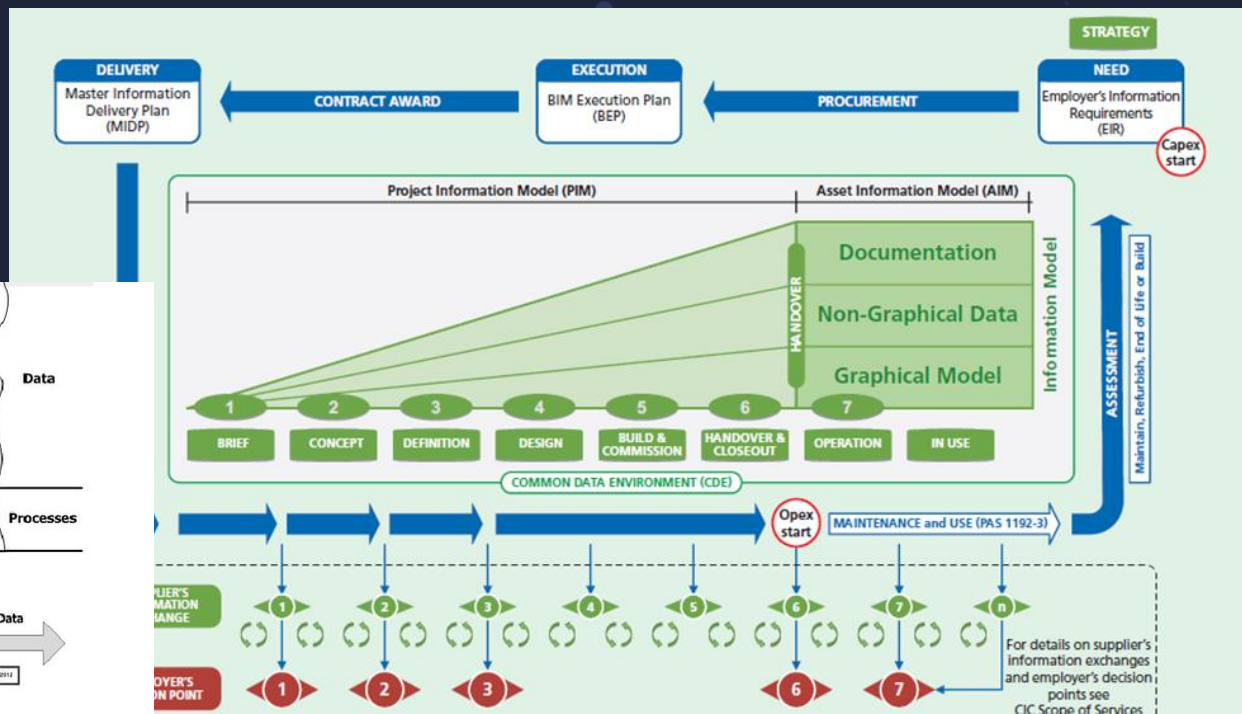
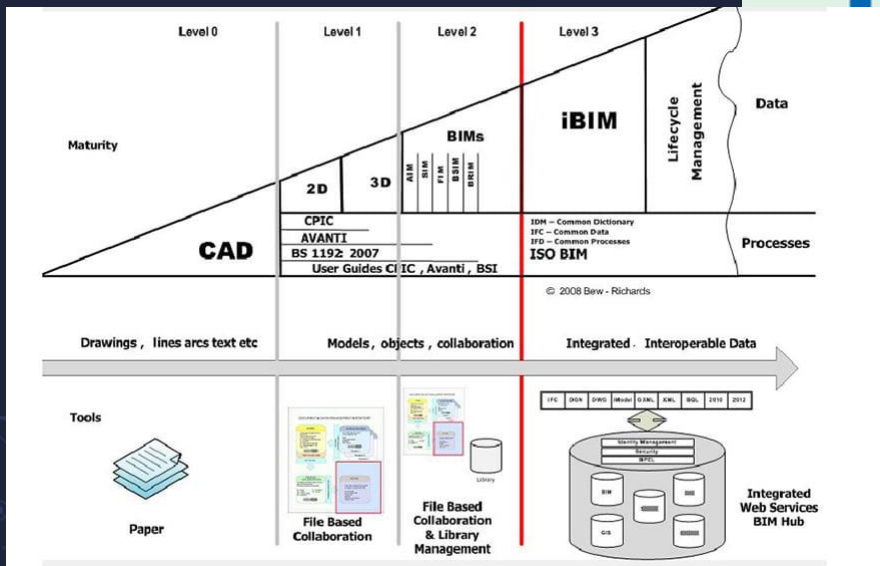


# How AI and BIM disrupt the construction planning process

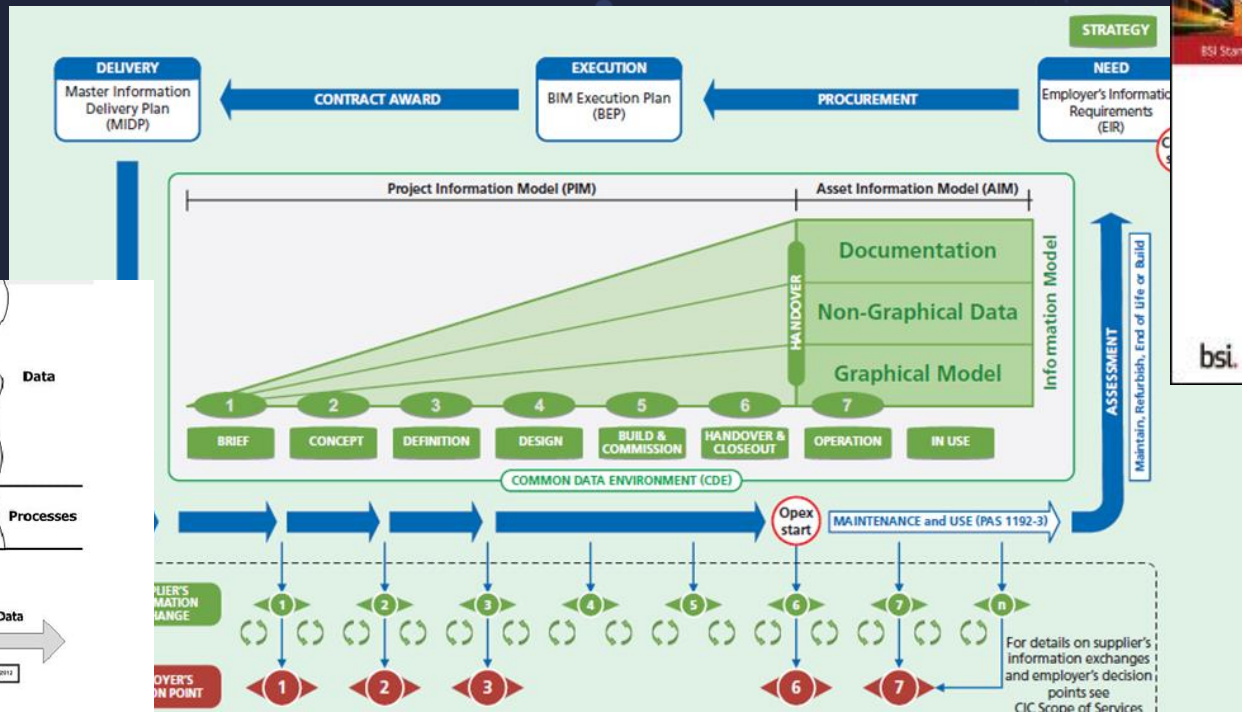
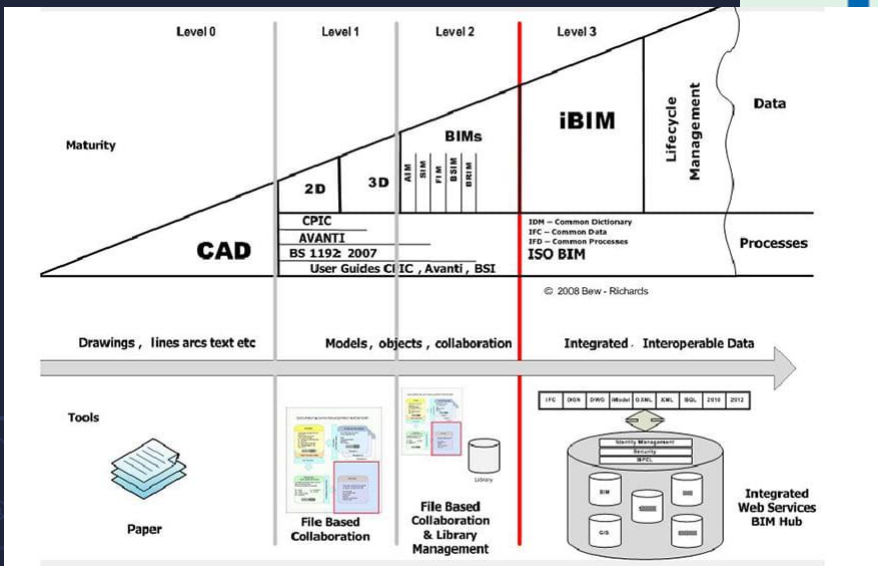
Implications and opportunities for the housing sector

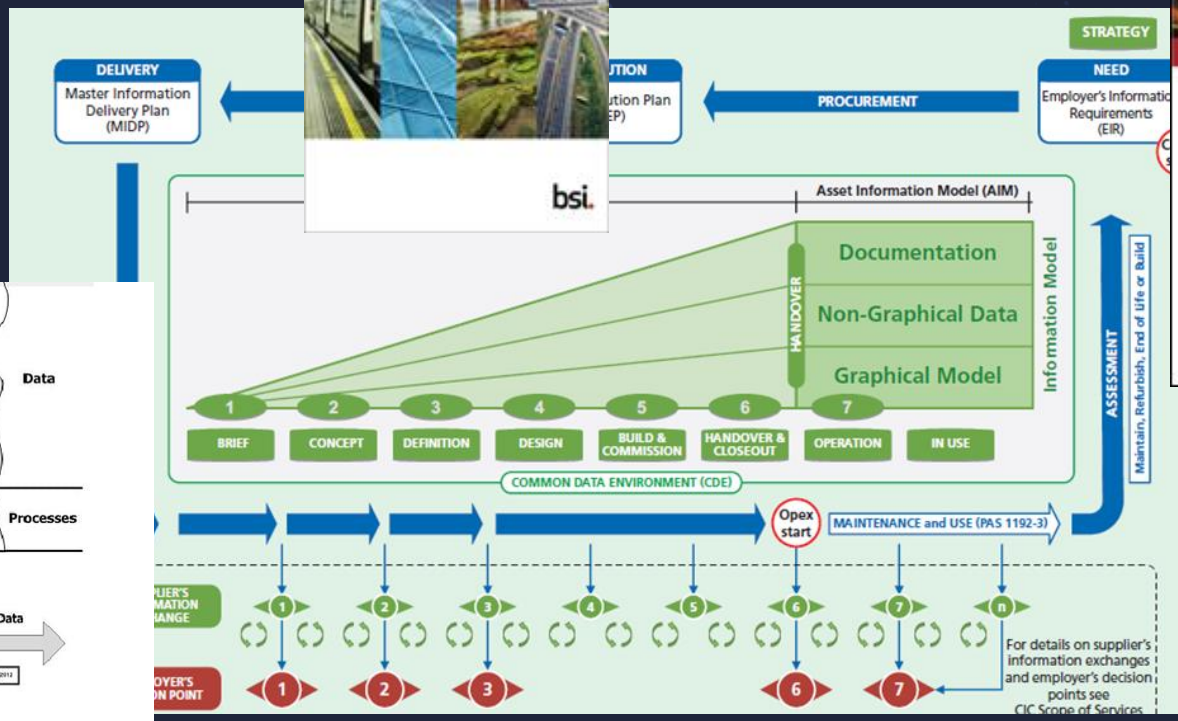
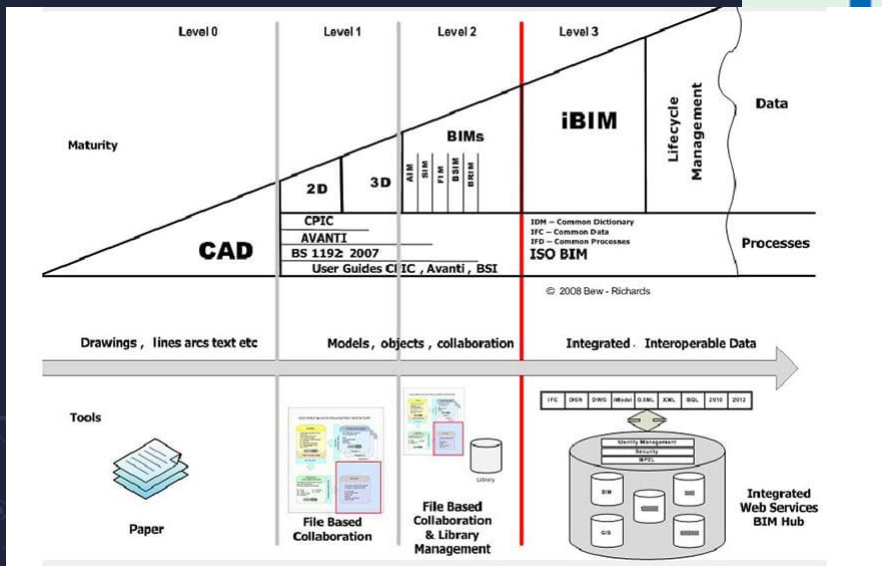
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Virtual Design & Construction  
Building Information Modelling  
Single Source of Truth  
Virtual Design & Construction  
Master Data Management  
Digital Engineering & Construction  
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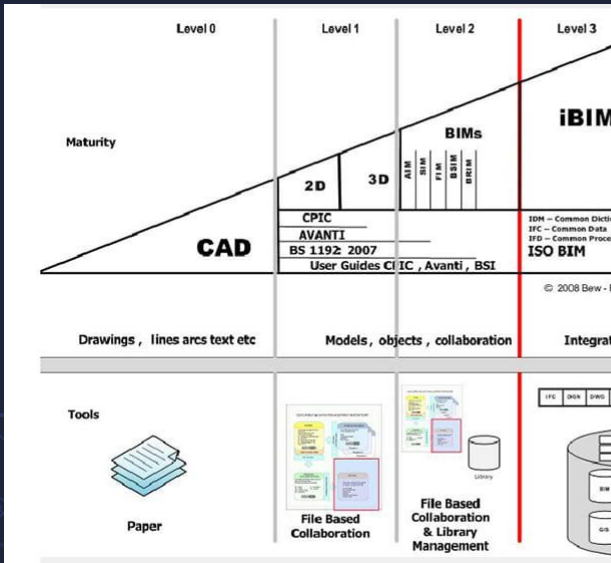


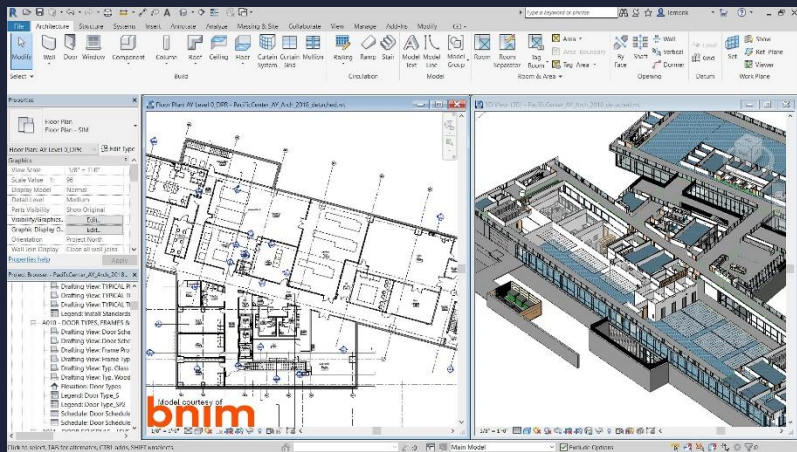




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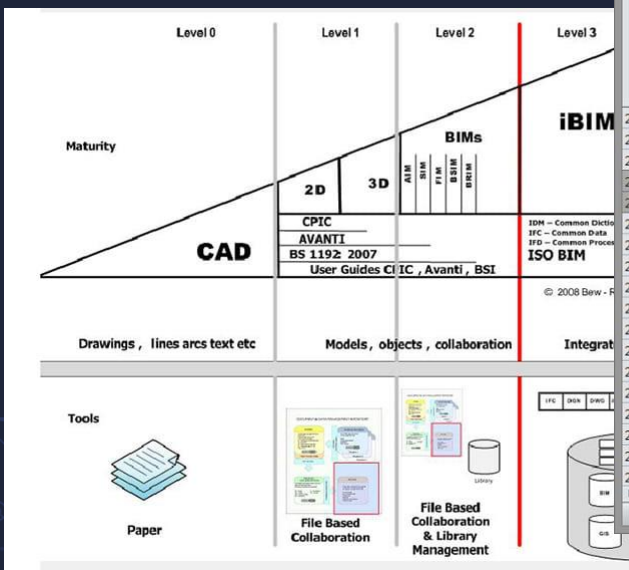
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Rootball securing assembly	info@ABCArchitecture.com	2017-04-05	Pr_45_63_64_72 : Rootball securing frames	Rootball securing asse	enquiries@greenleaftrees.co.uk	SASDMA
Stakes	info@ABCArchitecture.com	2017-04-05	Pr_45_63_64_84 : Stakes	Stakes	sales@jacksons-fencing.co.uk	Tree Stakes
Tree grilles	info@ABCArchitecture.com	2017-04-05	Pr_45_63_64_87 : Tree grilles	Tree grilles	msf.sales@marshalls.co.uk	OLTG204, Oll
Tree guards	info@ABCArchitecture.com	2017-04-05	Pr_45_63_64_88 : Tree guards	Tree guards	msf.sales@marshalls.co.uk	OLTR301, Oll
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Scale inhibitor chemicals for op	info@ABCArchitecture.com	2017-04-05	Pr_60_55_96_77 : Scale inhibitor chemical	Scale inhibitor chemi	Submit proposals.	
Dosing pots	info@ABCArchitecture.com	2017-04-05	Pr_60_55_97_07 : Biocide dosing pots ; Pr	Dosing pots	Submit proposals.	
Gas fired condensing boilers	info@ABCArchitecture.com	2017-04-05	Pr_60_60_08_34 : Gas fired condensing bo	Gas fired condensing b	Submit proposals.	
Storage water heaters, gas fired	info@ABCArchitecture.com	2017-04-05	Pr_60_60_96_34 : Gas-fired storage water	Storage water heaters	Submit proposals.	
Immersion heaters	info@ABCArchitecture.com	2017-04-05	Pr_60_60_96_42 : Immersion heaters	Immersion heaters	Submit proposals.	
Low temperature hot water hea	info@ABCArchitecture.com	2017-04-05	Pr_60_65_37_47 : Low temperature hot wa	Low temperature hot v	Submit proposals.	
PVC-U solid wall below ground	info@ABCArchitecture.com	2017-04-05	Pr_65_52_07_88 : Unplasticized polyvinyl	PVC-U solid wall below	Submit proposals.	
Covers and gratings for floor gu	info@ABCArchitecture.com	2017-04-05	Pr_65_52_24_30 : Floor gully covers and gr	Covers and gratings fo	Submit proposals.	
Floor gullies	info@ABCArchitecture.com	2017-04-05	Pr_65_52_24_31 : Floor gullies	Floor gullies	Submit proposals.	
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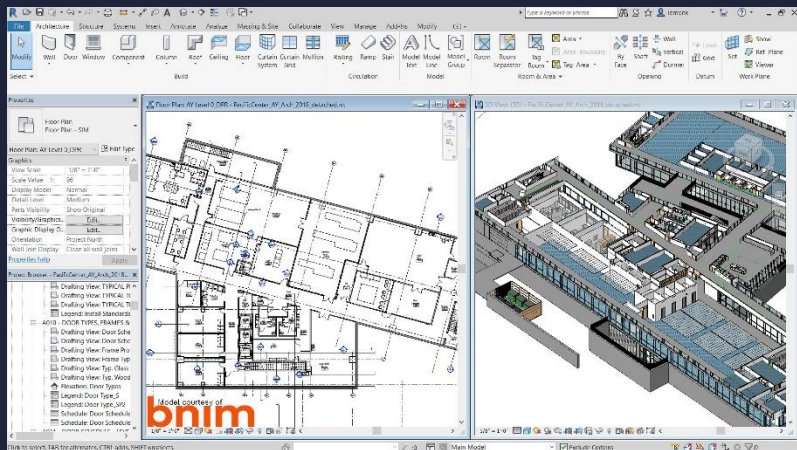


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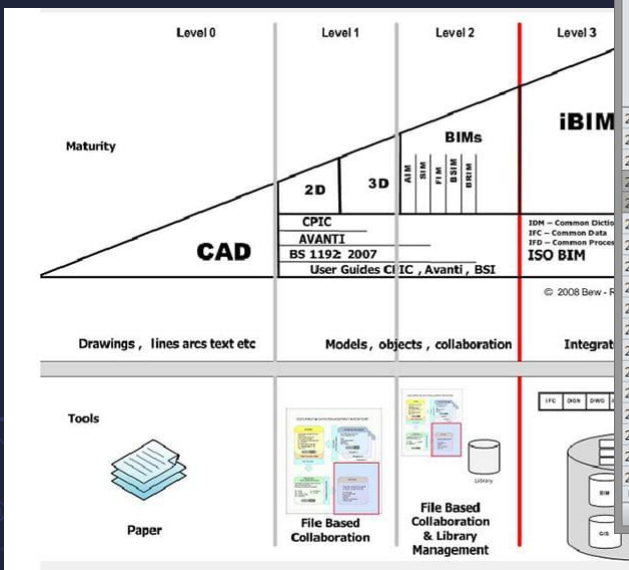
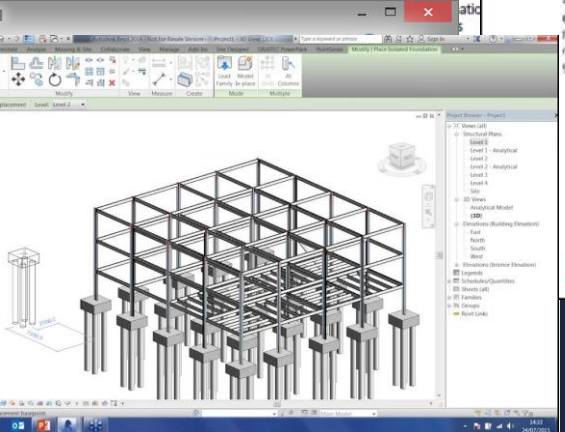






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- “This is the way we’ve always done it”
- “We’re winning projects so we shouldn’t break what’s working”
- “We don’t have time to change the way we work”

- “Our partners will never be able to use BIM”
- “Our leadership are close to retirement so won’t change things now”

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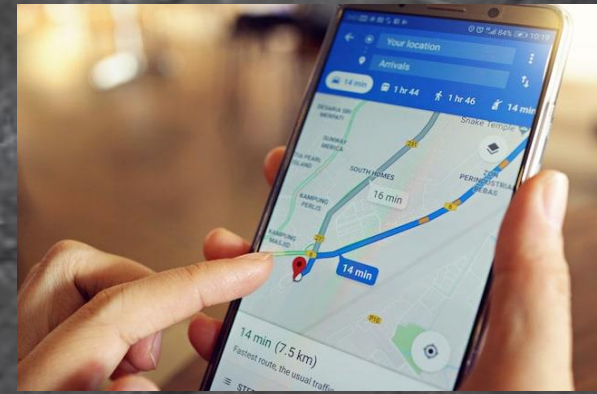
- “Our partners will never be able to use BIM”
- “Our leadership are close to retirement so won’t change things now”

**Time to change the conversation.**



# What is AI? Where is it used?

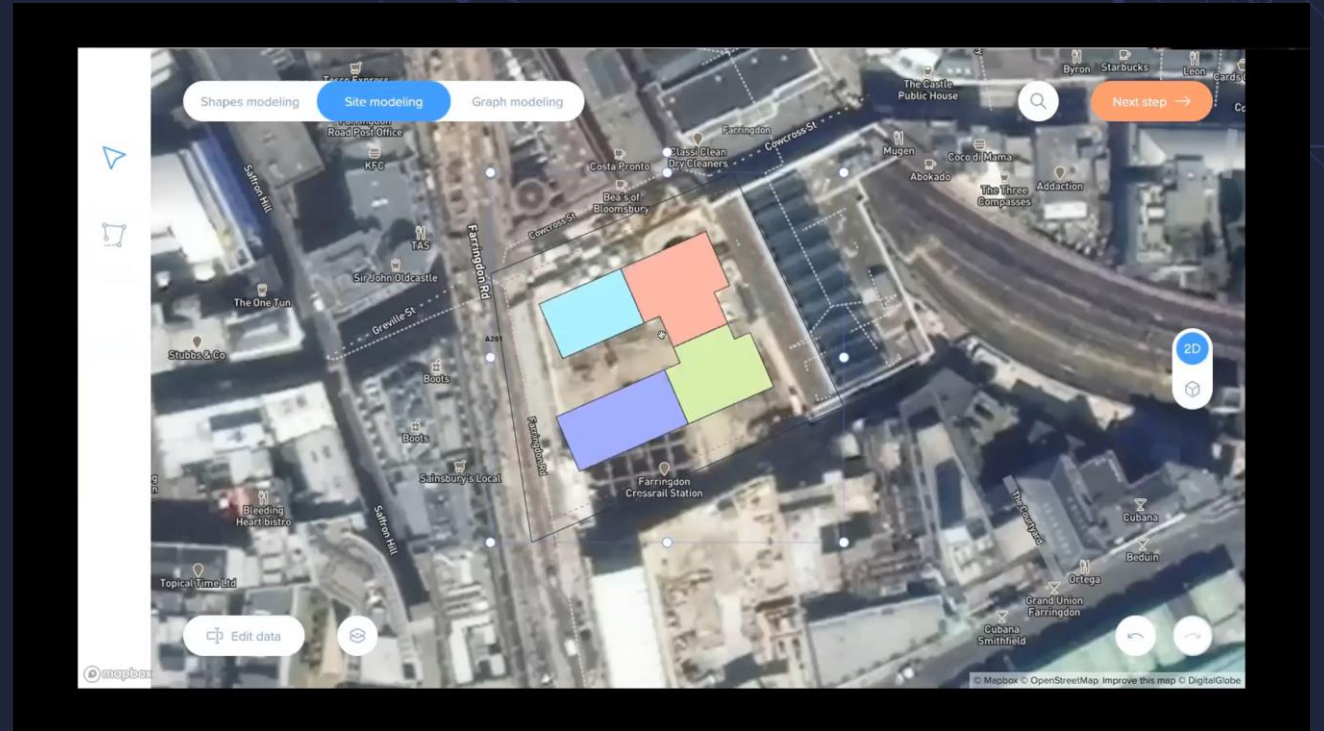
The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.



# AI in BIM...

## What can it do?

- Generative design
- BIM element classification
- 4D BIM (build scheduling)
- Resource allocation
- Optioneering
- Risk management
- So much more...



# New project



Enter your project name below

Project name

Enter project name



Project name



Type of building



Building frame



Floor height



Number of floors



AI For Better Construction **Planning**



@kreo\_software



KreoSoftware



kreosoftware



kreosoftware

# Transform the housing sector

Better quality building planning at speed



# Digital innovation in construction and asset management

## Speakers

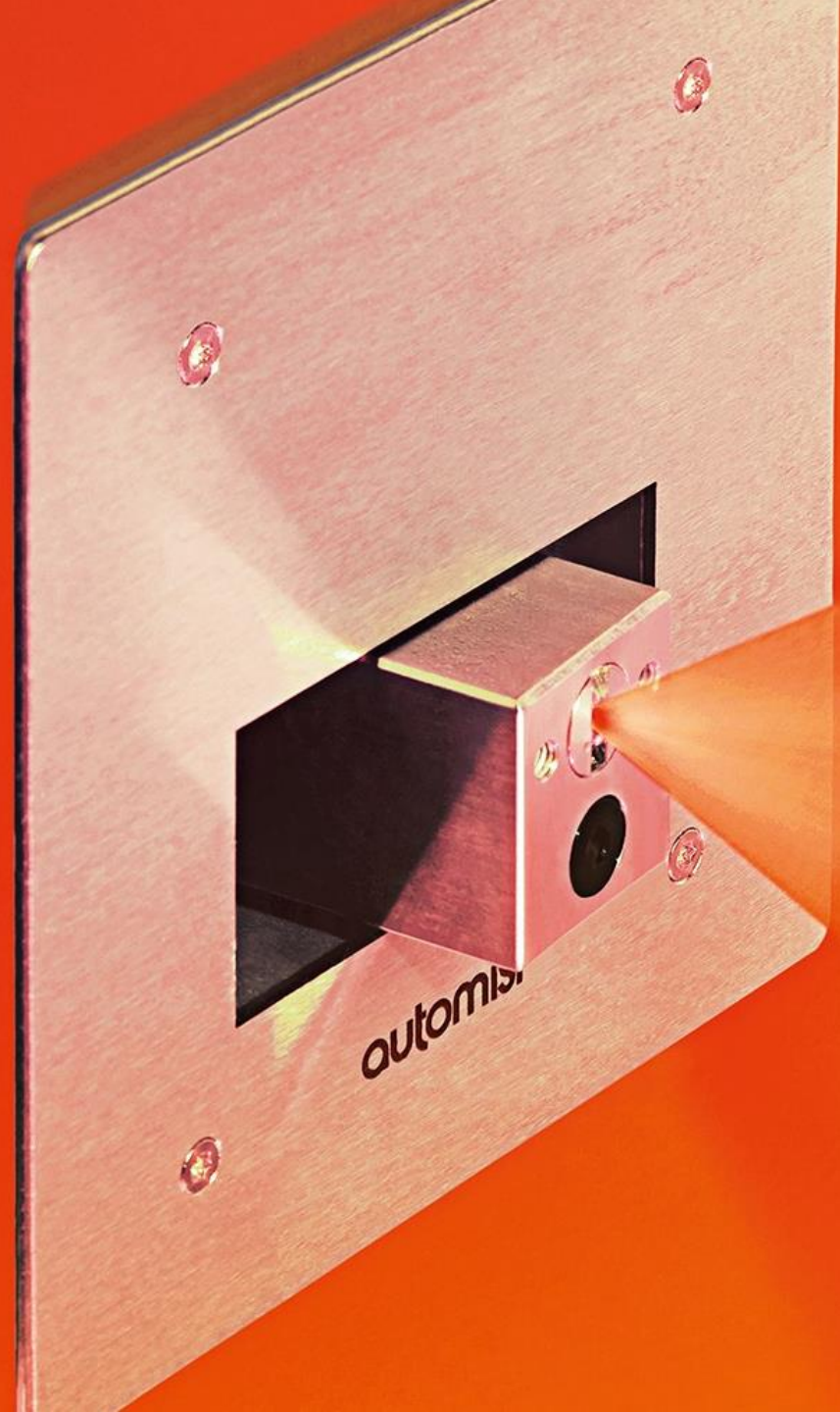
**Dr Gemma Burgess**, acting director Cambridge Centre for Housing and Planning Research, University of Cambridge

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**Julia Valentine**, director, Kreo

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# Saving lives with intelligent fire protection

Nov 2019





# Yusuf Muhammad & William Makant Cofounders of Plumis Ltd



theguardian

## The innovators: mist system offers a safer way to control fires

The creators of Automist explain how a fine mist can cool and suppress fires more effectively than sprinkler systems, especially when caused by chip pans



## The Telegraph

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Budget Companies Comment Personal Finance ISAs Economy Markets Property Enterprise

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### Sir James Dyson backs kitchen taps to save lives and launches 2010 competition

Royal College of Art graduates create fire extinguishing system using water mist sprayed from kitchen taps and plan to launch the product by the end of the year thanks to a £10,000 award from Sir James Dyson



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## Red Dot 2016 Product Design Winners Announced

BY JANA PERKOVIC | MARCH 31, 2016



Red Dot Gala in the Aalto Theater in Essen, Germany (Courtesy Red Dot Awards)

#### RELATED

VENUES  
Red Dot Design Museum

ARTISTS  
Phillippe Starck

The winners of the prestigious Red Dot Awards 2016 have been announced in the category of Product Design.

A record 5,200 products were submitted this year in the Product Design category, including firms and designers from 57 countries. The jury, consisting of 41 experts, was also the biggest ever, assembling in the Ruhr area of Germany to assess in situ every object submitted for the award.





Reducing fire deaths  
and injuries...

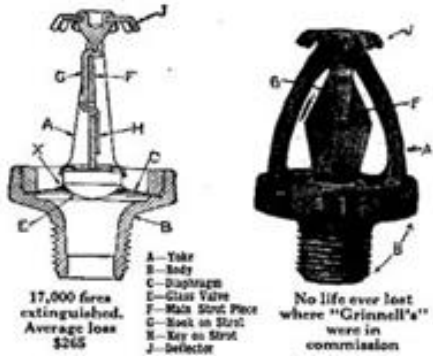
...by ensuring intelligent  
fire protection is in the fabric  
of every building

# The evolution of the fire sprinkler

## GRINNELL AUTOMATIC SPRINKLERS

"Standard of the World"

Protect more than \$2,000,000,000 of Business Value



17,000 fires  
extinguished.  
Average loss  
\$265

No life ever lost  
where "Grinnell's"  
were in  
commission

Insurance saving and interest, \$425,000,000

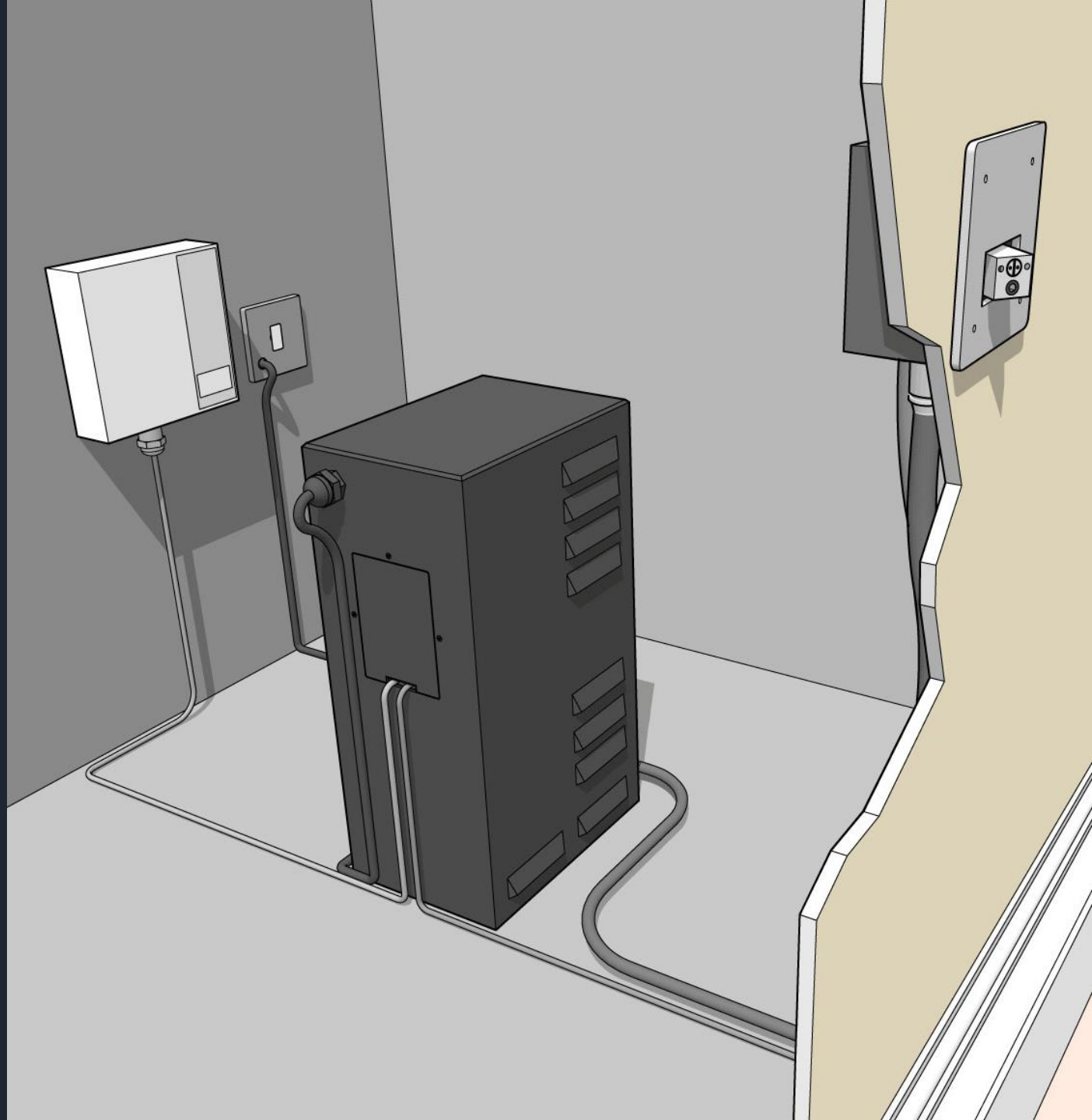
General Fire Extinguisher Company  
277 West Exchange St., PROVIDENCE, R. I.



1882

Today

# What is Automist Smartscan?







KEEP CLEAR · DO NOT COVER

Automist



00:01:02

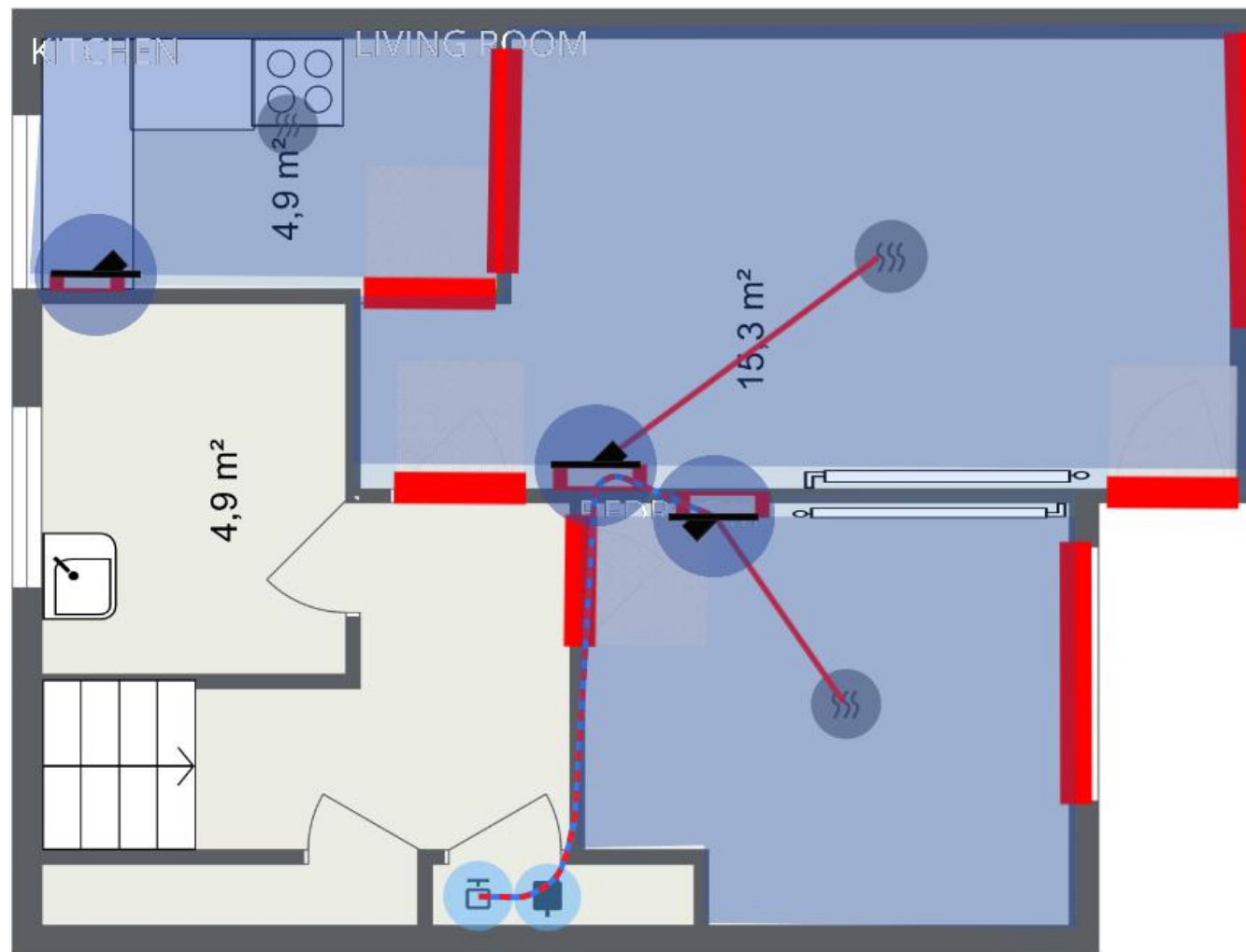


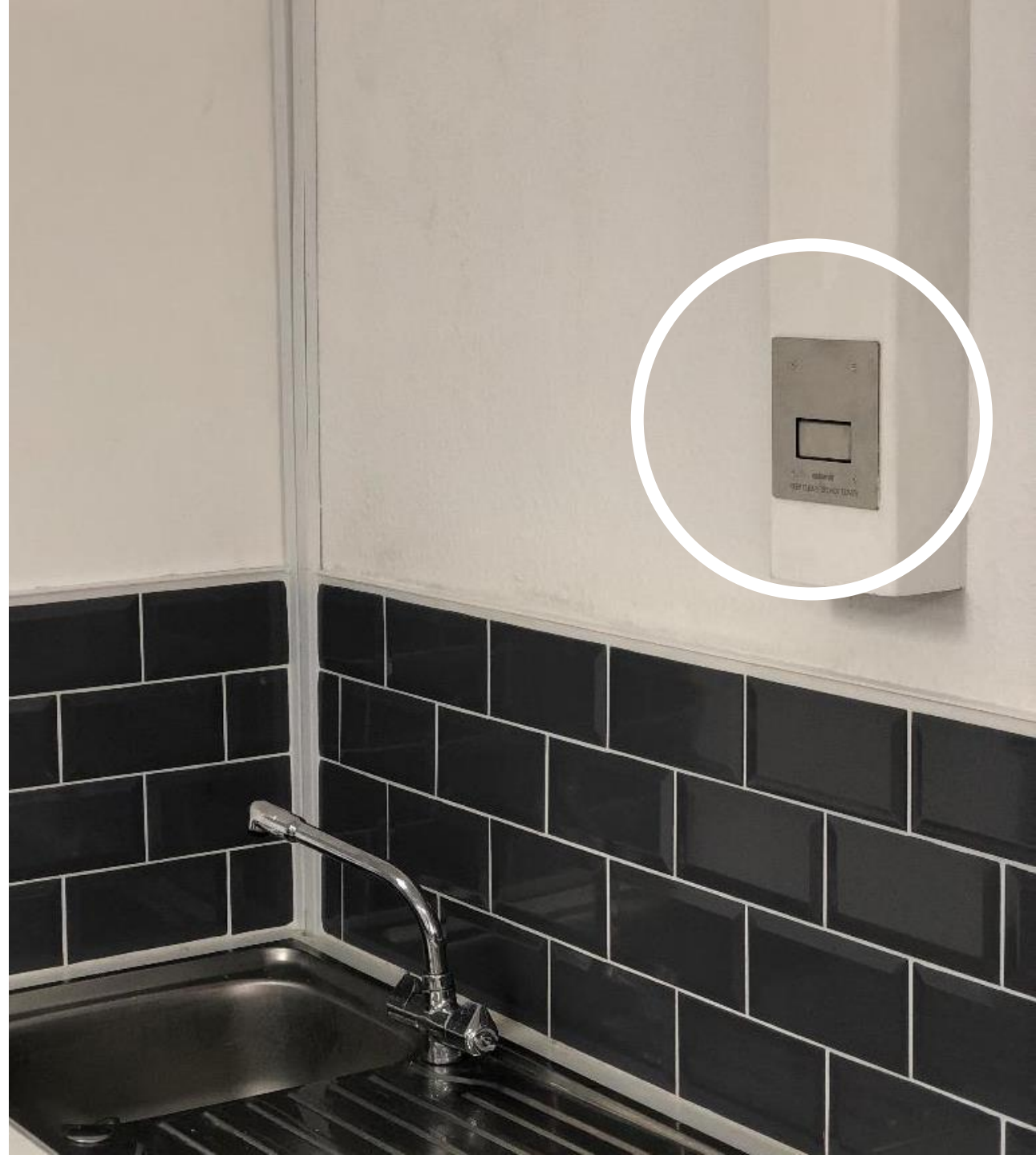
Automist Smartscan



Residential Sprinkler

# Sheltered housing retrofit



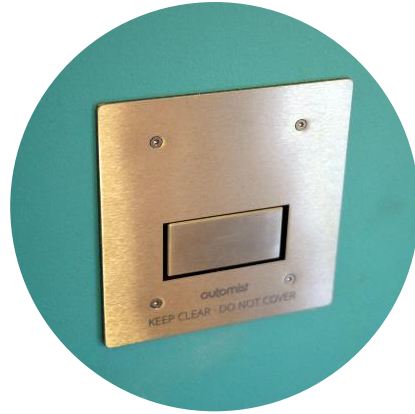
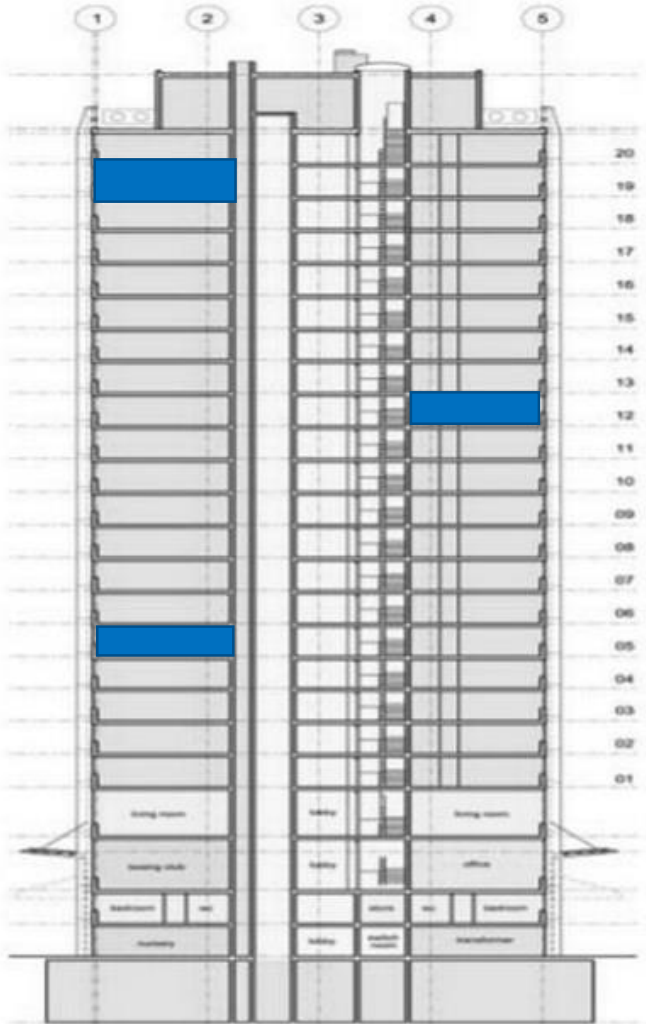






# Leaseholder vs freeholders

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Attractive design



Flats fitted independently using existing water supply



Phased installation following risk

Why are housing associations & councils choosing us?





# Problem with a traditional approach



**Installation**



**Water damage**



**Concealed fires**



**Perception**

# Intelligent fire safety



**Installation**



**Water damage**



**Concealed fires**



**Perception**



# Thankyou for listening

Plumis



THE QUEEN'S AWARDS  
FOR ENTERPRISE:  
INNOVATION  
2016



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