

PRELIMINARY PART L1A 2013 ASSESSMENT OF A SELECTION OF APARTMENTS

SUMMARY

THE CHOCOLATE FACTORY



SUMMARY OF PART L1A CALCULATIONS

February 2018 | Rev H

Approach

The Chocolate Factory development needs to comply with the London Plan requirement to achieve a 35% improvement over Building Regulations Part L 2013. This performance is to be achieved through a combination of passive design, energy efficiency, connection to energy efficient gas-boilers and roof-mounted PVs.

The aim of this detailed energy assessment carried out on a sample of 43 apartments are is to indicate the current performance of the three residential buildings against Part L1A 2013 in terms of passive design/energy efficiency.

The following specifications have been assumed in terms of thermal performance of the building fabric and the engineering services. Assumptions of the targeted thermal performance of junctions (thermal bridges) are also given.

FABRIC

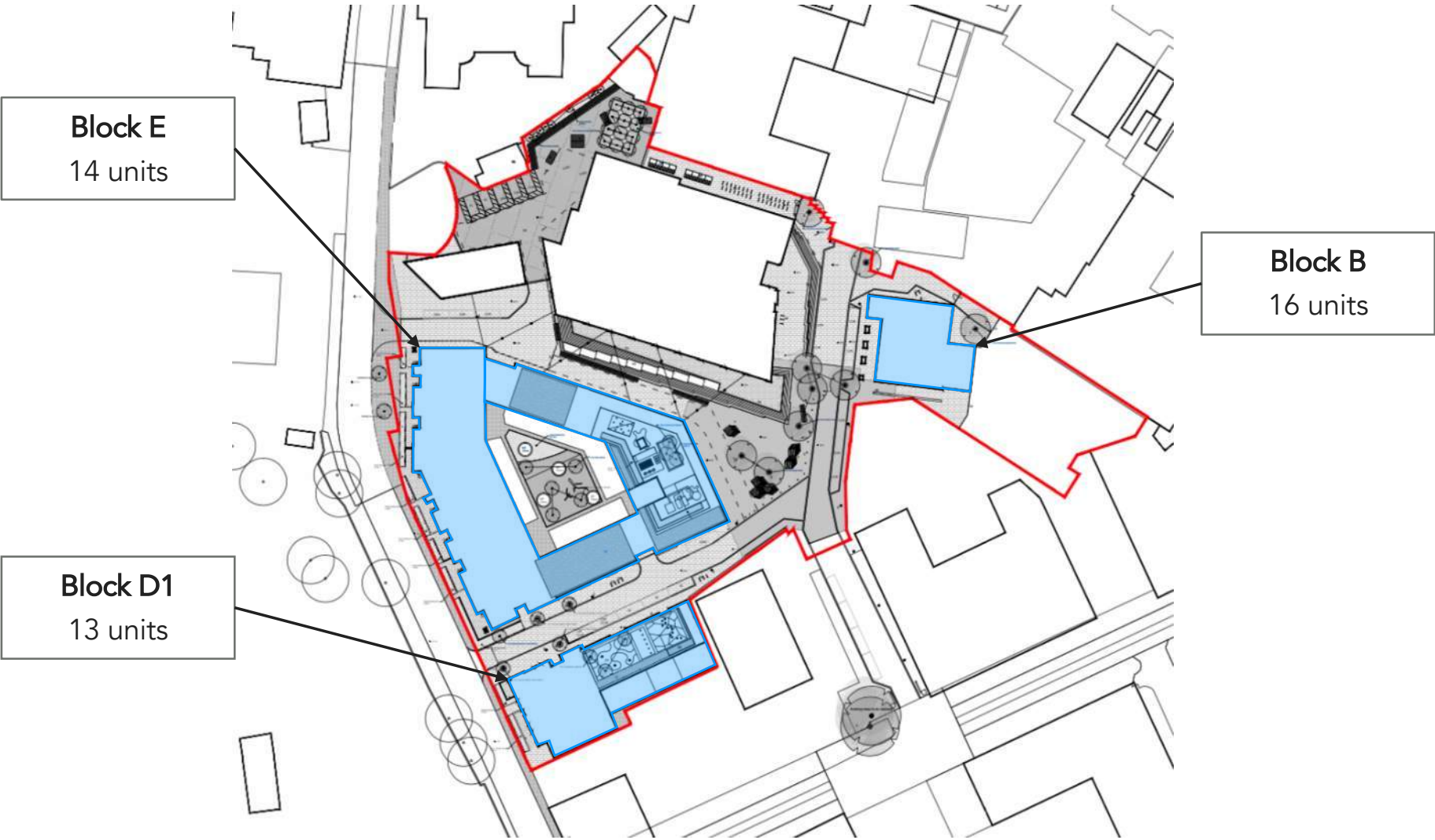
- External Wall U-value: 0.20 W/m².K
- Heated corridors and stairwells
- Wall to unheated spaces (e.g. bike store) U-value: 0.20 W/m².K
- Floor above external space U-value: 0.15 W/m².K
- Floor above unheated space U-value: 0.15 W/m².K
- Floor above commercial space U-value: 0.15 W/m².K
- Main roof U-value: 0.13 W/m².K
- Other roofs U-value: : 0.13 W/m².K
- Window U-value: 1.40 W/m².K (double-glazed) – U-value is for the whole system including glass, frame and edge effects
- Window g-value: 0.50
- Frame proportion: 25%
- Air permeability rate: 3 m³/h/m² at 50 Pa
- Thermal bridges: see adjacent table

BUILDING SERVICES

- Efficient Mechanical Ventilation with Heat Recovery in all units (SFP = 0.7 W/l/s – HR efficiency = 90%)
- 100% energy efficient lighting
- No mechanical cooling

Please note that the above set of specifications is preliminary and subject to changes.

Summary of Part L1A Calculations | The Chocolate Factory



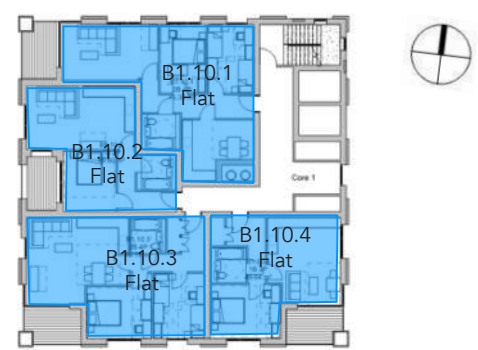
Thermal performance of key junctions:

- Lintel (E2) Ψ : 0.06 W/m.K
- Sill (E3) Ψ : 0.10 W/m.K
- Jamb (E4) Ψ : 0.05 W/m.K
- Ground floor / external wall junction (E5) Ψ : 0.08 W/m.K
- Intermediate floor between dwellings / external wall junction (E7) Ψ : 0.05 W/m.K
- Balcony (E9) Ψ : 0.15 W/m.K
- Gable (insulation at ceiling level) (E12) Ψ : 0.08 W/m.K*
- Gable (insulation at rafter level) (E13) Ψ : 0.08 W/m.K
- Flat roof / external wall junction (E14) Ψ : 0.08 W/m.K*
- Corner (normal) (E16) Ψ : 0.09 W/m.K
- Corner (inverted) (E17) Ψ : - 0.09 W/m.K
- Party wall between dwellings / external wall junction (E18) Ψ : 0.06 W/m.K

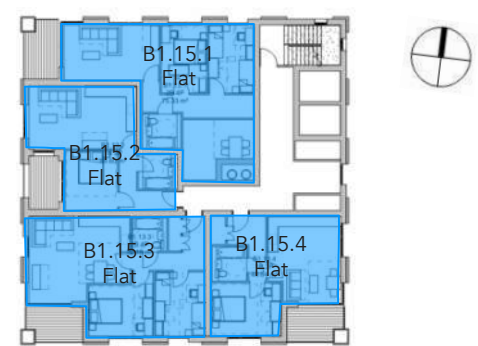
- Exposed floor or floor above unheated to external wall – normal (E20) Ψ : 0.10 W/m.K*
- Exposed floor or floor above unheated to external wall – inverted (E21) Ψ : 0.32 W/m.K*
- Ground floor / party wall junction (P1) Ψ : 0.08 W/m.K*
- Intermediate floor within a dwelling / party wall junction (P2) Ψ : 0.00 W/m.K*
- Intermediate floor between dwellings / party wall junction (P3) Ψ : 0.00 W/m.K
- Roof (insulation at ceiling level) / party wall junction (P4) Ψ : 0.02 W/m.K*
- Roof (insulation at rafter level) / party wall junction (P5) Ψ : 0.02 W/m.K
- Head of roof window (R1) Ψ : 0.06 W/m.K
- Sill of roof window (R2) Ψ : 0.10 W/m.K
- Jamb of roof window (R3) Ψ : 0.05 W/m.K
- Roof to wall (rafter) (R8) Ψ : 0.15 W/m.K
- Roof to wall (flat ceiling) (R9) Ψ : 0.08 W/m.K

Block B

Summary of Part L1A Calculations | The Chocolate Factory



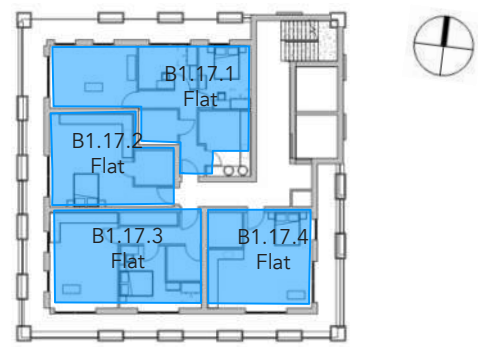
10th Floor - Mid



15th Floor - Mid

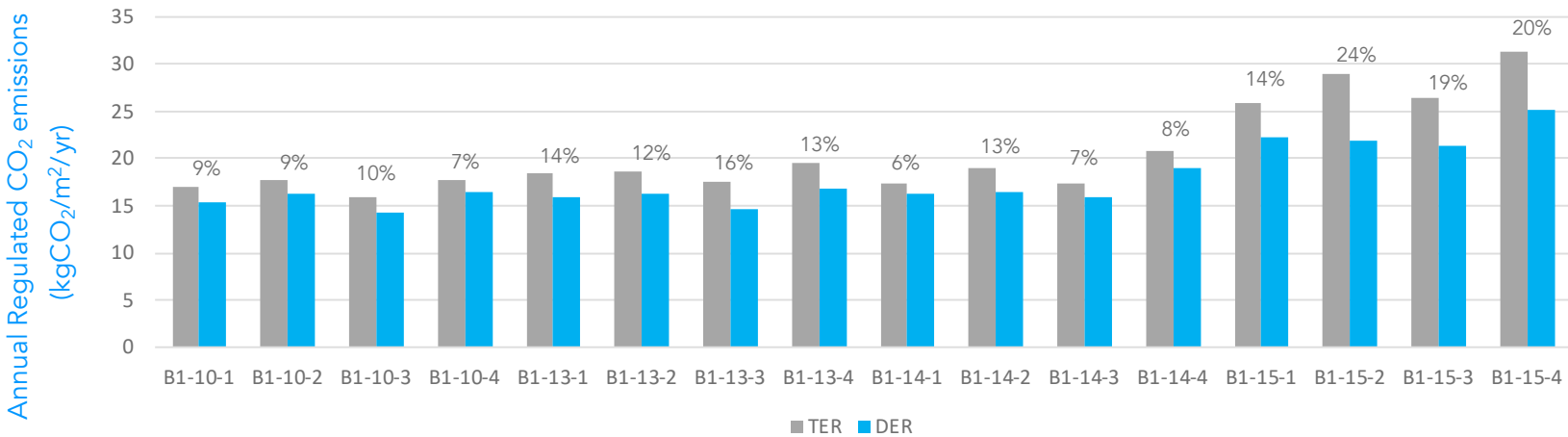


16th Floor - Mid



17th Floor - Top

Performance against Part L 2013 - (energy efficiency only)

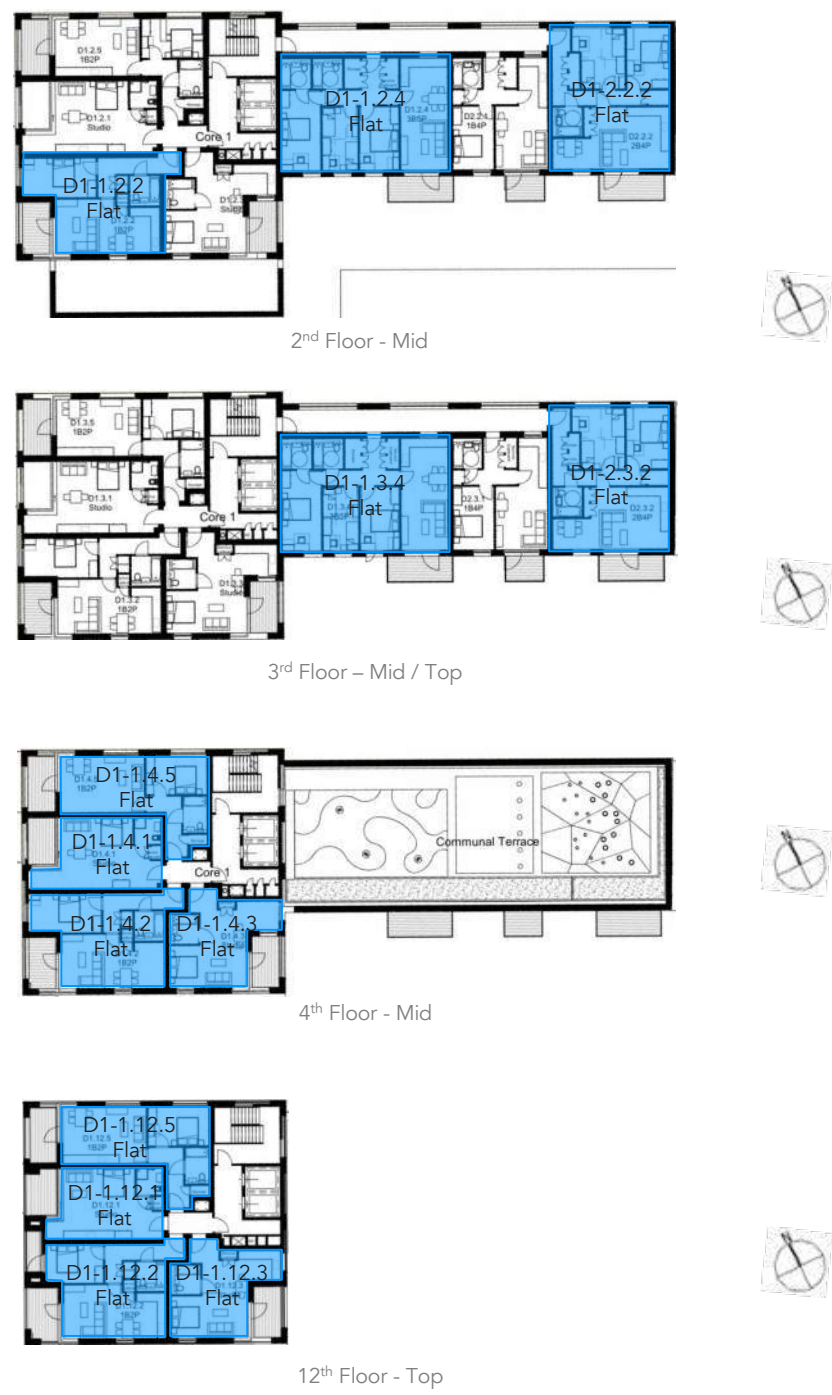


Improvement
on Part L
2013

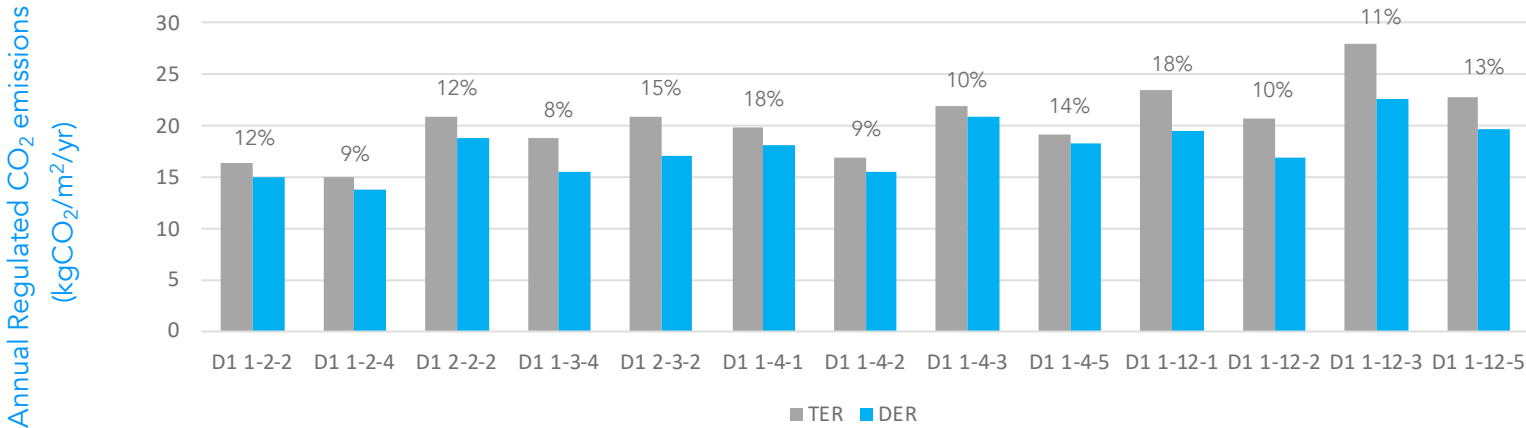
-13%

Block D1

Summary of Part L1A Calculations | The Chocolate Factory



Performance against Part L 2013 - (energy efficiency only)



Improvement on Part L 2013

-13%

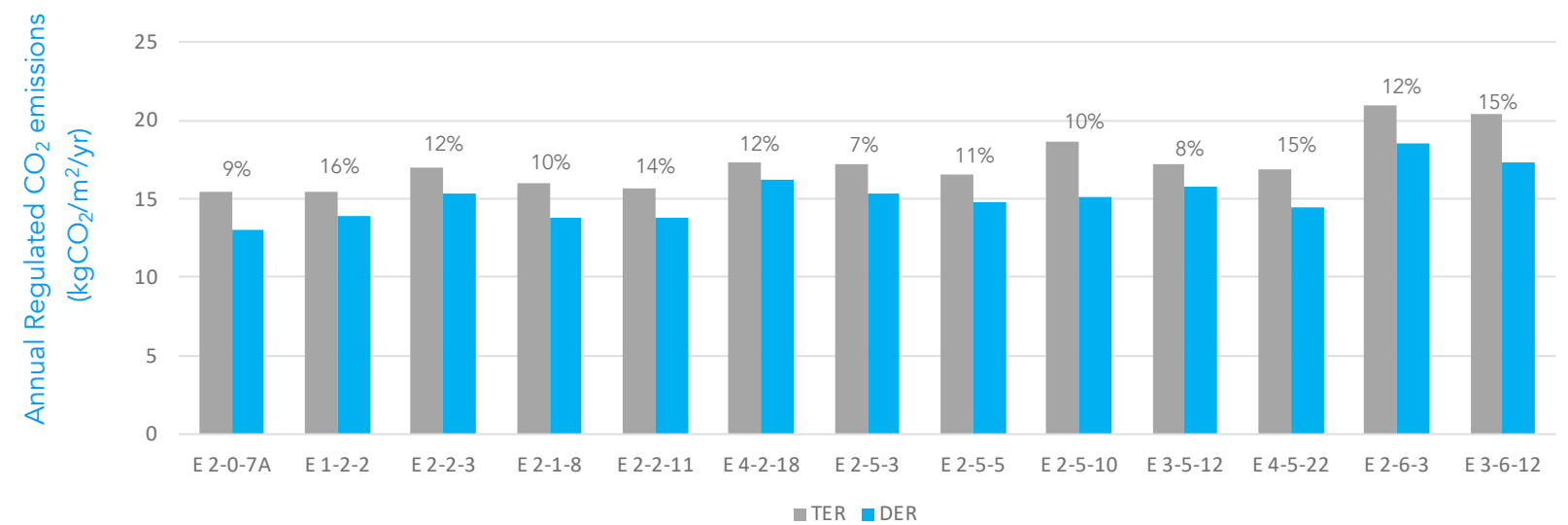
Block E

Summary of Part L1A Calculations | The Chocolate Factory

Block E



Performance against Part L 2013 - (energy efficiency only)



Improvement on Part L 2013

-12%

Conclusion

This report summarises the detailed energy assessment of 43 dwellings at the Chocolate Factory.

In summary, the results are positive as, based on the assumed fabric and services specifications, the residential buildings are likely to achieve the following performance against Part L1A 2013, from passive design and energy efficiency only (i.e. before the connection to any community heating system and the inclusion of any PVs):

- **Block B:** 13% CO₂ reduction against Part L1A 2013
- **Block D1:** 13% CO₂ reduction against Part L1A 2013
- **Block E:** 12% CO₂ reduction against Part L1A 2013

The above are estimates based on area-weighted averages.

Summary of Part L1A Calculations | The Chocolate Factory

PRELIMINARY PART L2 ASSESSMENT OF BLOCK A

SUMMARY

THE CHOCOLATE FACTORY



ENERGY STRATEGY FOR BLOCK A

August 2017 | Rev B

Summary

This note summarises the proposed energy strategy and Part L modelling undertaking for Block A at the Chocolate Factory. It focuses on the fabric energy performance of the building and potential improvements.

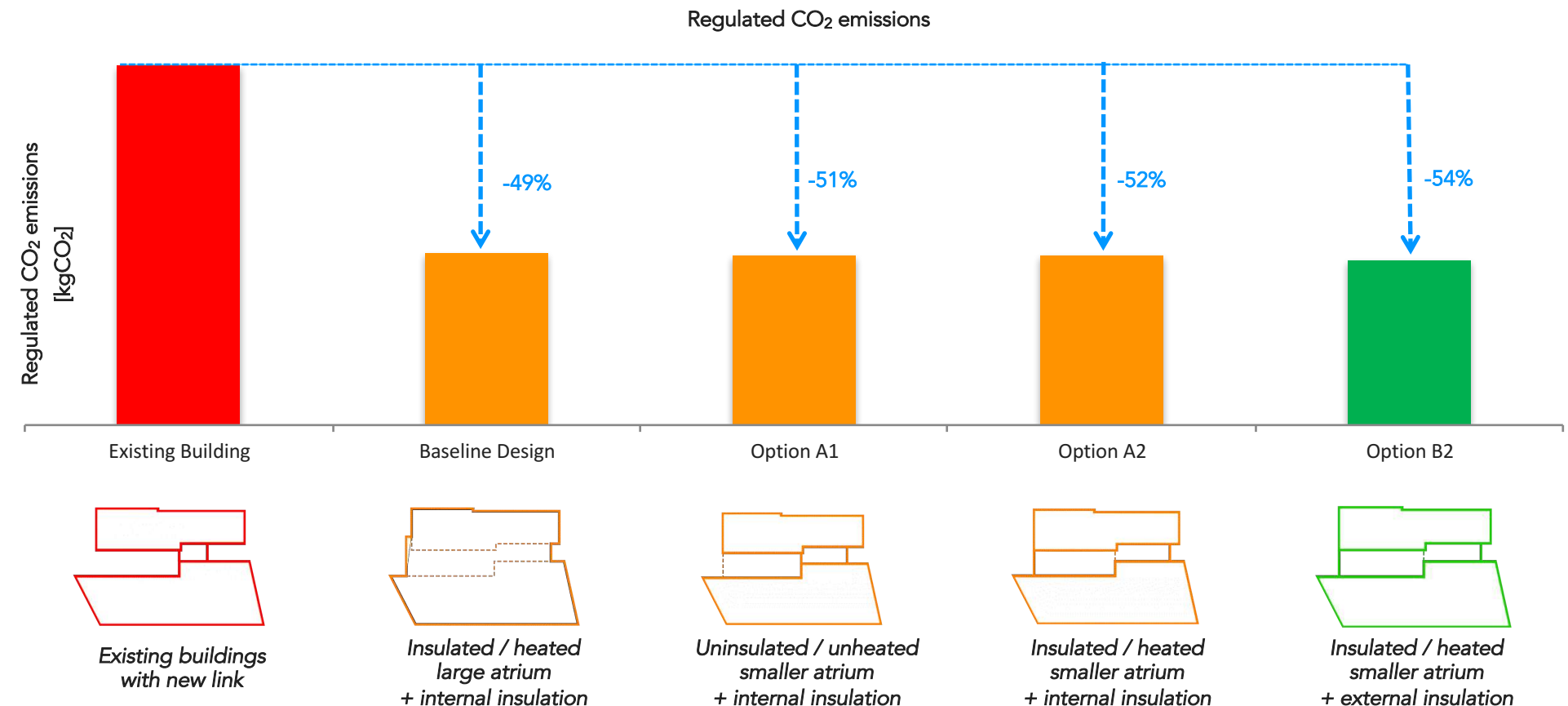
The building has been modelled using EDSL Tas software (v 9.3.3) based on drawings provided by Barton Willmore Architects. As part of the design development four potential strategies were compared to a baseline case representing the existing building. The strategies have been based on drawings and discussions with the architects, and reflect the current scheme proposals.

Significant **regulated CO₂ emissions savings** can be achieved for all proposed options for Block A of the Chocolate Factory in comparison to the baseline:

- **Baseline Design** achieves a **49% CO₂ reduction**;
- **Option A1** achieves a **51% CO₂ reduction**;
- **Option A2** achieves a **52% CO₂ reduction**;
- **Option B2** achieves a **54% CO₂ reduction**.

These figures are fairly similar as the baseline has very high regulated CO₂ emissions. When focusing on the four refurbishment options only and on their estimated energy requirements, the differences between the four options become clearer (see adjacent figure). Our conclusions are that:

1. Reducing the volume of the atrium would be beneficial and is recommended;
2. There are marginal differences between the two reduced atrium options (A1 and A2) and the most cost efficient options between insulating the atrium and not the walls facing on to the atrium or not insulating the atrium but insulating the walls facing on to the atrium can be selected.
3. Adopting an external insulation strategy for the existing facades, as is proposed in option B2, will offer the highest reduction in CO₂ emissions and heating consumption of all options. For conservation reasons it is however not considered to be feasible.
- 4.



Recommendations

All options deliver an approximate 50% improvement in regulated CO₂ emissions over the baseline building with existing fabric/services performance

Options A1 and A2 with atrium stopping at 4th floor level achieve very similar results and therefore the most cost efficient of the two can be taken forward.

Further reductions in energy consumption are possible using external wall insulation. For conservation reasons it is however not considered to be feasible.



Screenshots of one of the energy models (with the smaller atrium)

Context

This note summarises the proposed energy strategy for Block A at the Chocolate Factory. It focusses on the fabric energy performance of the building and potential improvements.

Four potential strategies were compared to the baseline of a notional existing building.

Motivation

There are four main drivers for improving the energy performance and predicted carbon emissions of Block A during the refurbishment works:

1. Reduced energy use and carbon emissions

Improving the fabric performance of the building directly reduces carbon emissions and would contribute to the carbon reduction efforts required to meet planning requirements.

2. Improved internal environmental performance

Improving the building fabric reduces the demand and cost of running building services while improving the internal space for occupants.

3. BREEAM Non-domestic refurbishment 2014

A 'Very Good' rating is targeted including 7 credits under category Ene01. This is directly influenced by fabric energy efficiency as carbon emissions.

4. Building regulations Part L2B 2013

Compliance with minimum fabric energy efficiency requirements necessary due to the refurbishment.



Photo of the the existing buildings.

Existing building

The existing buildings (currently called block B and block C) are solid wall concrete frame construction with large single glazed steel framed windows. Buildings of this type typically have a number of inherent energy performance and internal comfort issues:

- Very cold internal surfaces making it necessary for higher internal air temperatures to achieve a comfortable and productive working environment.
- Significant temperature gradients across and vertically in rooms creating cool drafts and discomfort for occupants. Particularly for stationary and seated individuals.
- Poor levels of winter air quality where windows and doors are temporarily sealed or tightly shut to reduce heat loss which lead to much lower levels of ventilation.
- Recurring condensation and moisture on the internal face of windows and some exposed structure. This can put finishes, air quality and building structure at risk.
- Potential summer overheating in exposed and South facing rooms.
- A large heating demand requiring significant amounts of fuel with very high running costs.

Proposals

The proposals for this block are to sensitively and significantly improve the energy and sustainable performance while maintaining the character and integrity of these buildings.

The Chocolate Factory | Energy Strategy – Block A | Fabric Energy Efficiency

Existing building photographs

A site survey of the existing building shows the context for the renovation works.



The North elevation showing the brick detailing recesses and columns. Both internal and external masonry features are a key part of the building character.



Between the existing buildings showing the proposed atrium area. It is proposed to remove the external balconies on the building.



The South East elevation showing the range of external textures on the building



The steel lintel above windows is a major thermal bridge that will need to be addressed in the renovation works.



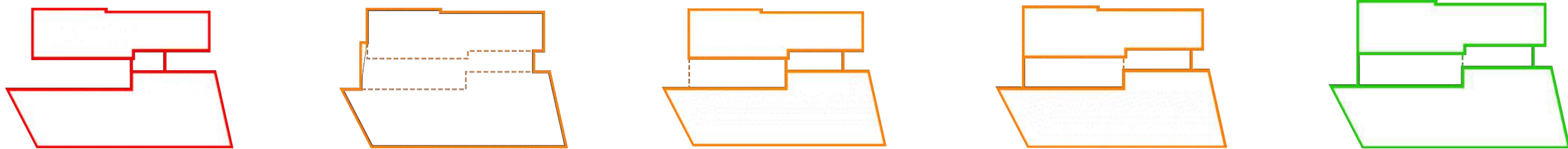
The steel windows have exceeded their working life and require replacement. The steel frame and single glazing has a significant impact on the internal environment.



Many of the windows no longer seal internally letting cold air into the building and creating drafts.

Summary

Four approaches to improving the fabric energy efficiency of Block A have been modelled, compared to the baseline and are presented for consideration:



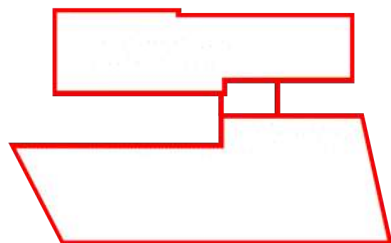
Baseline		Current design with atrium		Option A1		Option A2		Option B2		
Characteristics Advantages Restrictions and disadvantages	- The current building fabric performance. - Natural ventilation - Existing windows		- Insulation applied to accessible internal surfaces. Roof insulation externally. - Atrium between blocks to enclose space. - Walls facing the atrium do not have to be insulated - Replacement double glazing in same position as existing window line. - Improvement in air leakage rate - Mechanical ventilation system.		- Insulation applied to accessible internal surfaces. Roof insulation externally. - Atrium reduced to only cover required circulation space. - Walls facing the atrium have to be insulated - Replacement double glazing in same position as existing window line. - Improvement in air leakage rate - Mechanical ventilation system.		- Insulation applied to accessible internal surfaces. Roof insulation externally. - Atrium covers between building but stops at 5th floor. - Walls facing the atrium do not have to be insulated - Replacement double glazing in same position as existing window line. - Improvement in air leakage rate - Mechanical ventilation system.		- Moderate insulation applied to all external surfaces, including roof insulation. - Atrium covers between building but stops at 5th floor. - Walls facing the atrium do not have to be insulated - Replacement double glazing in line with external insulation (outside existing window plane). - Larger improvement in air leakage rate. - Mechanical ventilation system.	
	n/a		- External façade appearance is retained. - Installation can be achieved from inside the building. - Limited improvement to fabric energy efficiency. - Improvement in indoor air quality. - Retain internal atrium windows (assuming acoustic performance is met).		- External façade appearance is retained. - Installation can be achieved from inside the building. - Limited improvement to fabric energy efficiency. - Improvement in indoor air quality.		- External façade appearance is retained. - Installation can be achieved from inside the building. - Limited improvement to fabric energy efficiency. - Improvement in indoor air quality.		- Internal industrial appearance to units is retained. - Installation externally allows simple detailing and coherent strategy for whole building with no limit to performance from moisture risk. - Simple external airtightness strategy can be adopted to improve air leakage rate. - Significant improvement to fabric energy efficiency.	
	n/a		- Amount of wall insulation is limited to minimum U-value of 0.30W/m²K - Actual insulation performance is reduced significantly by repeat thermal bridging from concrete frame and steel connections. - Complicated and hard to resolve details between insulation and structure. Limited opportunity to improve infiltration. - Internal appearance of the outside walls is changed. - Internal services on outside walls need rerouting.		- Amount of wall insulation is limited to minimum U-value of 0.30W/m²K - Actual insulation performance is reduced significantly by repeat thermal bridging from concrete frame and steel connections. - Complicated and hard to resolve details between insulation and structure. Limited opportunity to improve infiltration. - Internal appearance of the outside walls is changed. - Internal services on outside walls need rerouting		- Amount of wall insulation is limited to minimum U-value of 0.30W/m²K - Actual insulation performance is reduced significantly by repeat thermal bridging from concrete frame and steel connections. - Complicated and hard to resolve details between insulation and structure. Limited opportunity to improve infiltration. - Internal appearance of the outside walls is changed. - Internal services on outside walls need rerouting		- External appearance of building is altered, (but existing finish and detailing can be replicated). - More complicated external detailing. - External access to facades required. - Additional insulation is compromised by lower performance glazing and air leakage. - Most window frames must be replaced. - External services and features need rerouting. E.g. external rain water pipes.	
Fabric performance (U-values)	Wall	2.0 W/m²K	Wall	0.30 W/m²K	Wall	0.30 W/m²K	Wall	0.30 W/m²K	Wall	0.18 W/m²K
	Roof	1.5 W/m²K (no insulation)	Roof	0.18 W/m²K	Roof	0.18 W/m²K	Roof	0.18 W/m²K	Roof	0.15 W/m²K
	Floor	0.4 W/m²K	Floor	0.4 W/m²K	Floor	0.4 W/m²K	Floor	0.4 W/m²K	Floor	0.4 W/m²K
	Windows	5.0 W/m²K (North block)	Windows	1.8 W/m²K (South block)	Windows	1.8 W/m²K (South block)	Windows	1.8 W/m²K (South block)	Windows	1.8 W/m²K (South block)
		5.0 W/m²K (South block)		1.2 W/m²K (North block)		1.2 W/m²K (North block)		1.2 W/m²K (North block)		1.2 W/m²K (North block)
	Curtain walling	n/a	Curtain walling	2.0 W/m²K	Curtain walling	2.0 W/m²K	Curtain walling	2.0 W/m²K	Curtain walling	2.0 W/m²K
Air permeability	15 m³/m²h	Air permeability	5 m³/m²h	Air permeability	5 m³/m²h	Air permeability	5 m³/m²h	Air permeability	3 m³/m²h	

Recommended approaches for this project

The Chocolate Factory | Energy Strategy – Block A | Design Development

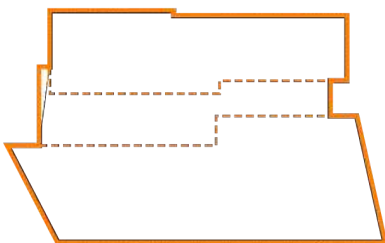
Approach

The baseline model and three options have been modelled using EDSL TAS (version 9.3.3). Some screen shots from the building model are shown below.



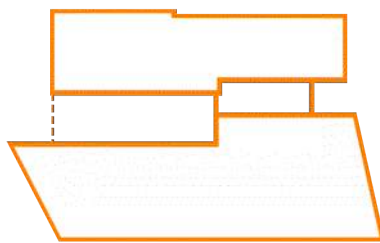
Baseline

Existing buildings with new link



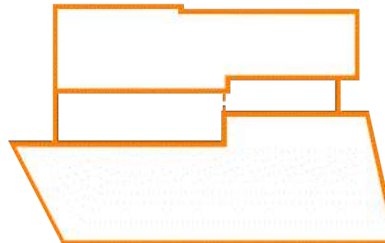
Current design with atrium

*Insulated / heated large atrium
+ internal insulation*



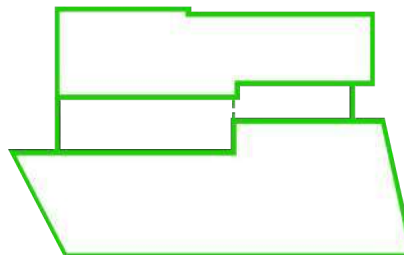
Option A1

*Uninsulated / unheated smaller atrium
+ internal insulation*



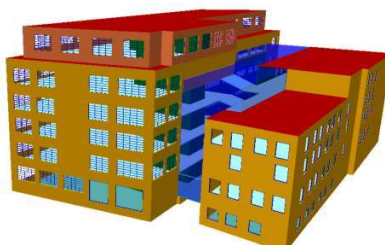
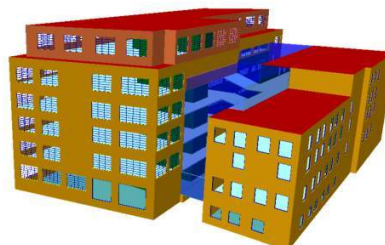
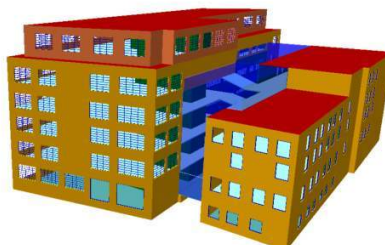
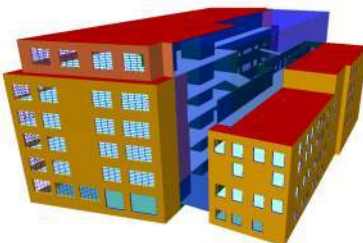
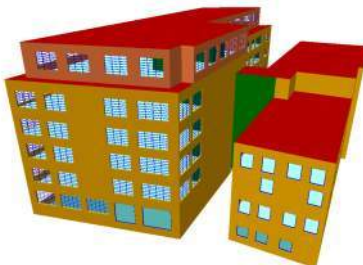
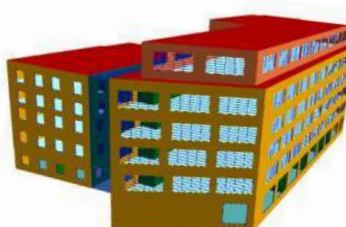
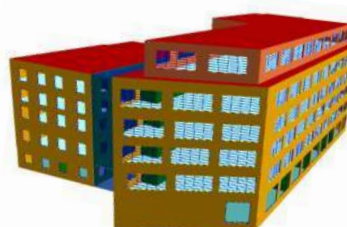
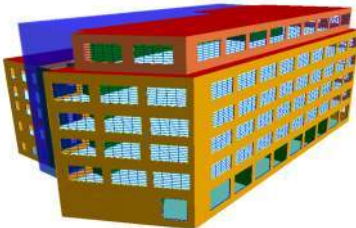
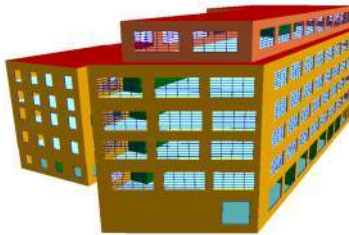
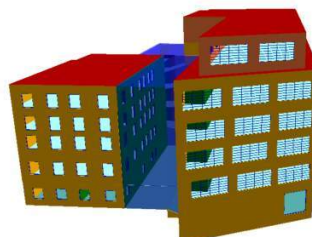
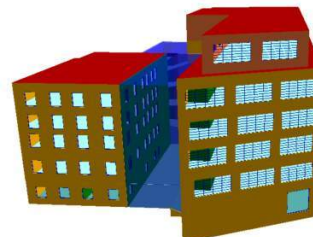
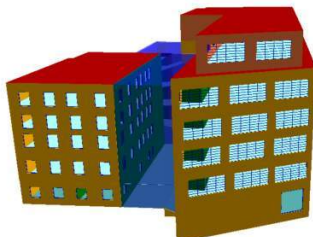
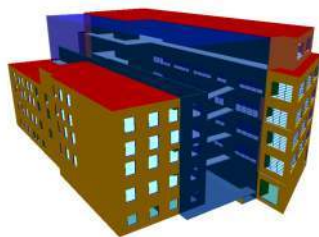
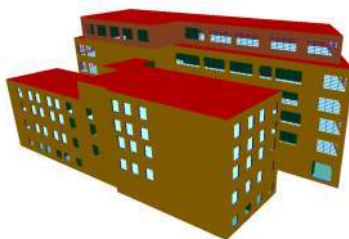
Option A2

*Insulated / heated smaller atrium
+ internal insulation*



Option B2

*Insulated / heated smaller atrium
+ external insulation*



Summary of initial energy modelling assessment

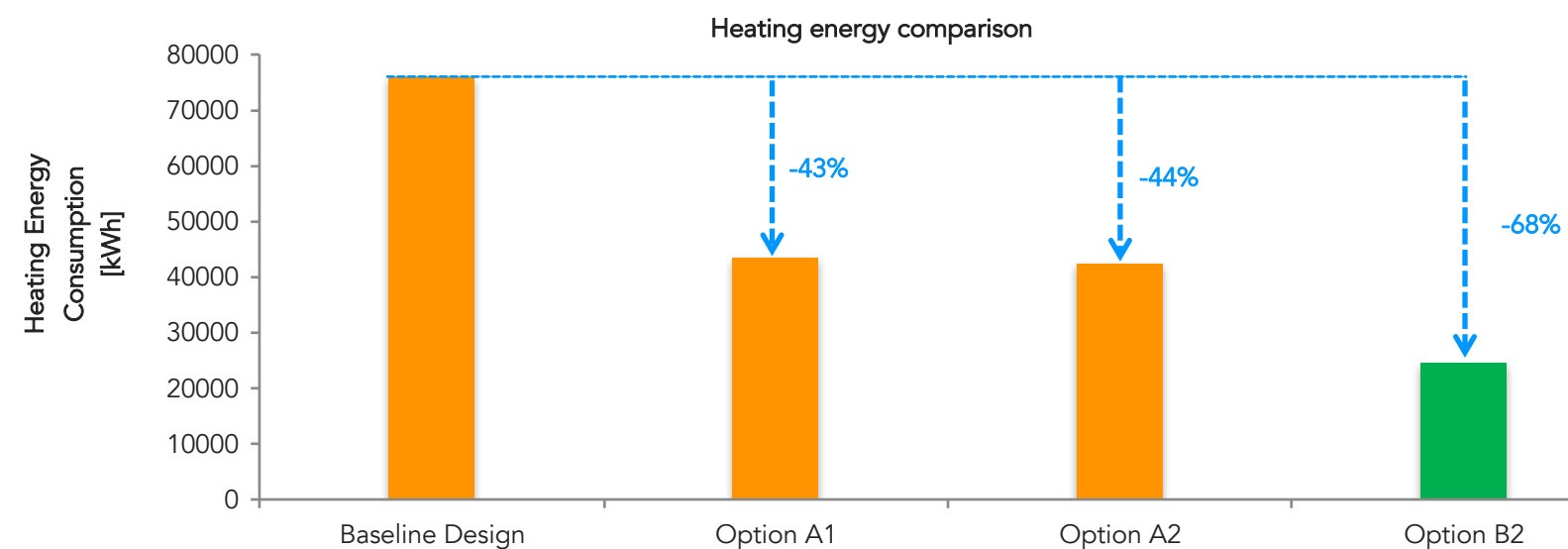
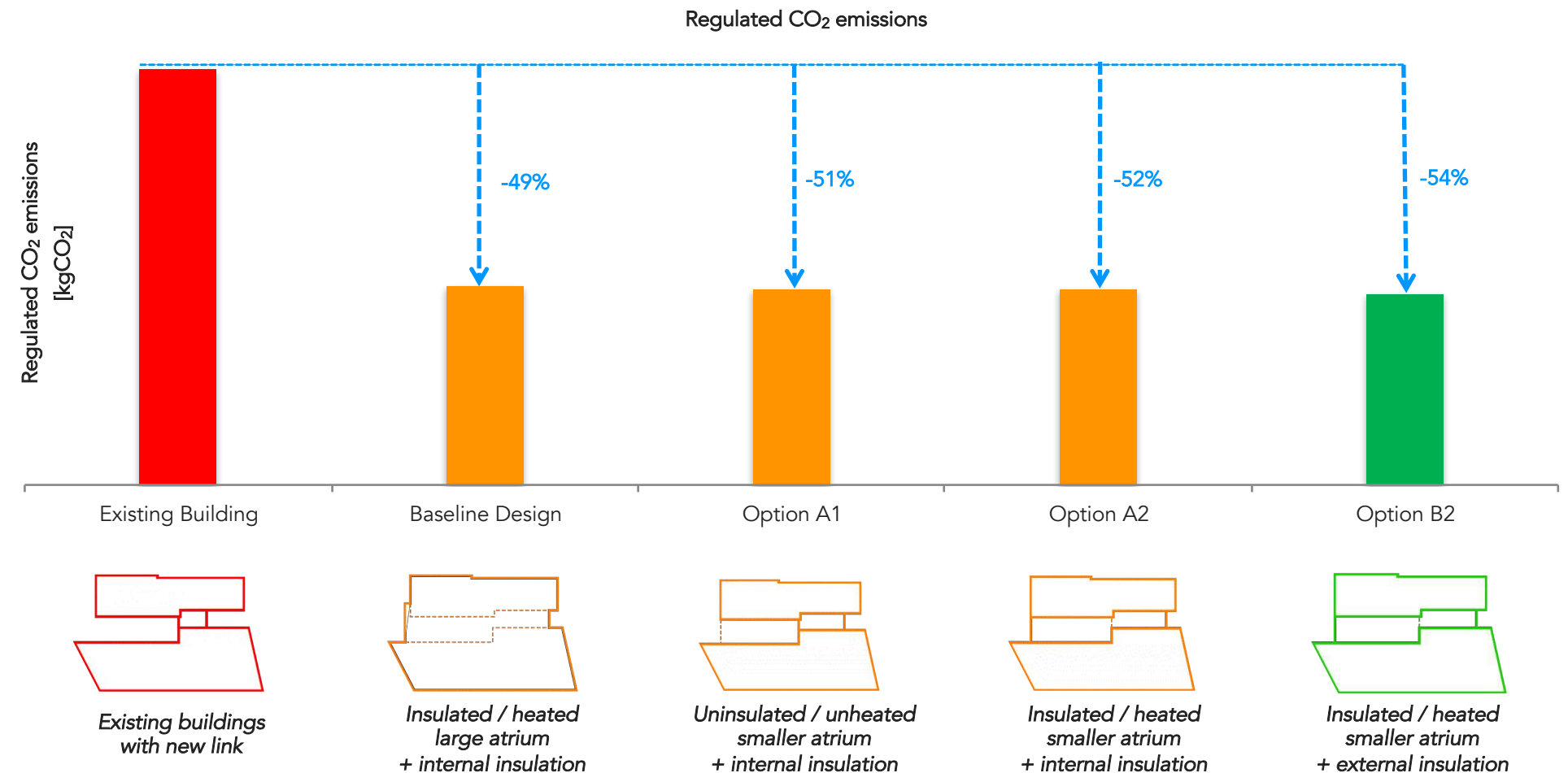
The initial energy modelling exercise conducted for Block A of the Chocolate Factory was undertaken to assess how improvements made to the building fabric impact on the expected heating demand and carbon emissions.

A comparison of the Building Emission Rate (BER) and expected heating energy use for each of the four design options of Block A of the Chocolate Factory is shown to the right.

Option B2 was found to have the lowest CO₂ emissions and heat energy consumption, however it relied on the use of external insulation on the walls, which is not considered desirable. The next best performing option was A2, which was nearly as good but used internal insulation instead.

Assumptions about the lighting, ventilation and other services to the building have been made and further refinements to the modelling will be required. These are likely to further reduce the BER.

1. All options deliver an approximate 50% improvement in regulated CO₂ emissions over the baseline building with existing fabric/services performance
2. By reducing the volume of the atrium, there is a substantial reduction in the heating demand for Options A1 and A2 in comparison to the current architectural design.
3. Options A1 and A2 with atrium stopping at 4th floor level achieve very similar results and therefore the most cost efficient of the two can be taken forward.
4. Further reductions in energy consumption are possible using external wall insulation. It is recommended that this is still considered during the next stage.



Introduction

After carrying out the initial assessment of the performance of various design options, the results and findings were used to develop the proposed design and test its impact against Part L.

A more accurate dynamic thermal model has been produced using Part L accredited DSM (Dynamic Simulation Modelling) software Tas (v9.4.1) to calculate the regulated carbon emissions savings of the proposed refurbishment and new-build extension.

Approach

In accordance with the requirements of the London Plan and Haringey's planning policy, the Chocolate Factory is targeting a 35% reduction in regulated CO₂ emissions compared to Part L 2013.

As Block A is primarily an existing building being refurbished, rather than a new-build, using the Part L2A TER (Target Emissions Rating) as its initial baseline was considered to be inappropriate. Instead a separate model was created of the existing building that included a minimum level of energy efficiency interventions that would enable it to comply with the minimum requirements of Part L2B (i.e. a minimum Building Regulations compliant case). This result was then aggregated with the new-build extension's Part L2A TER to generate the baseline CO₂ emissions.

Block A Carbon Reduction Strategy

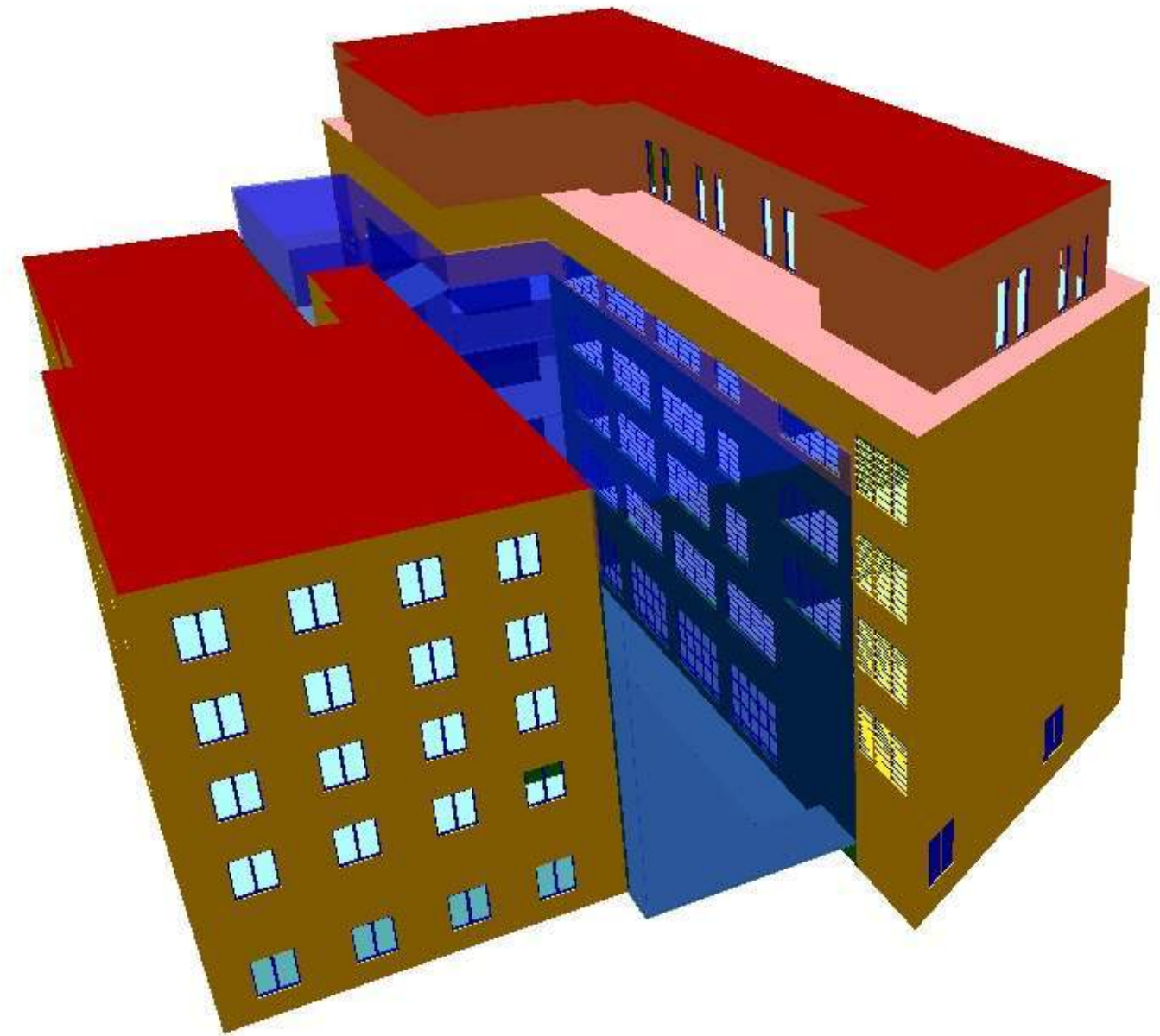
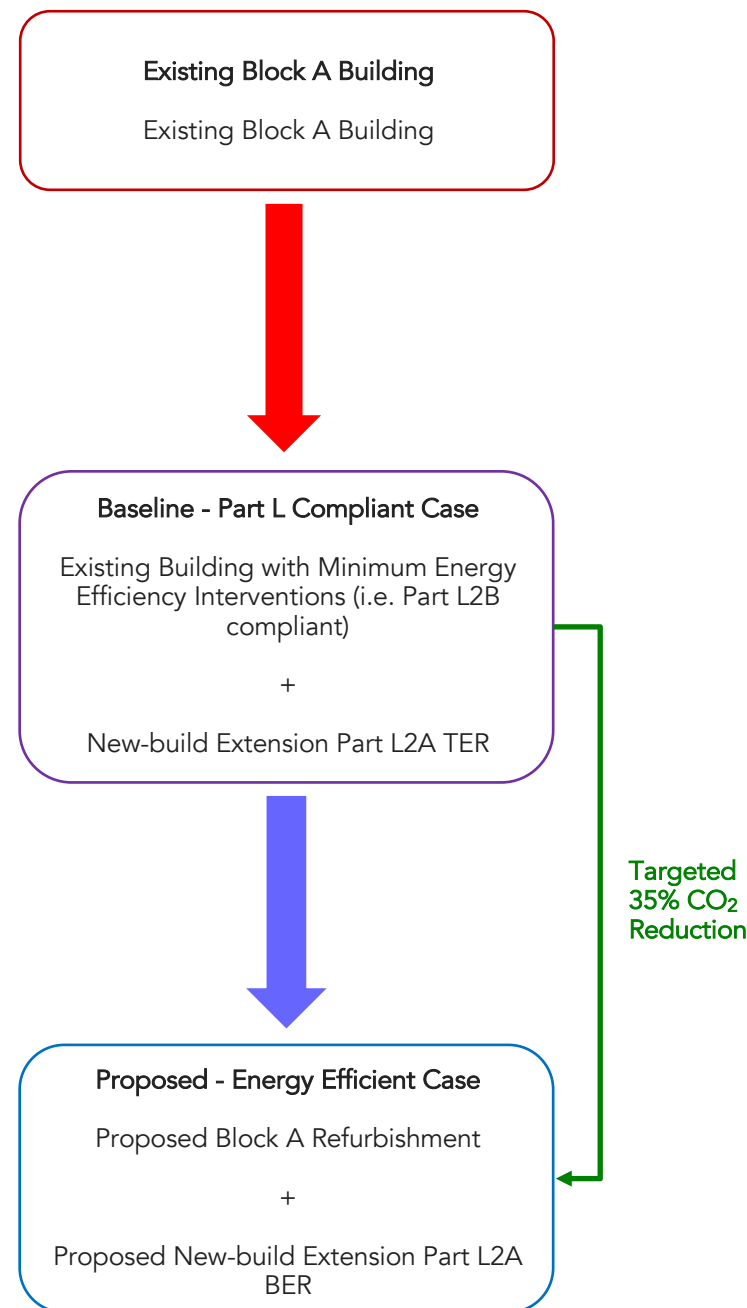


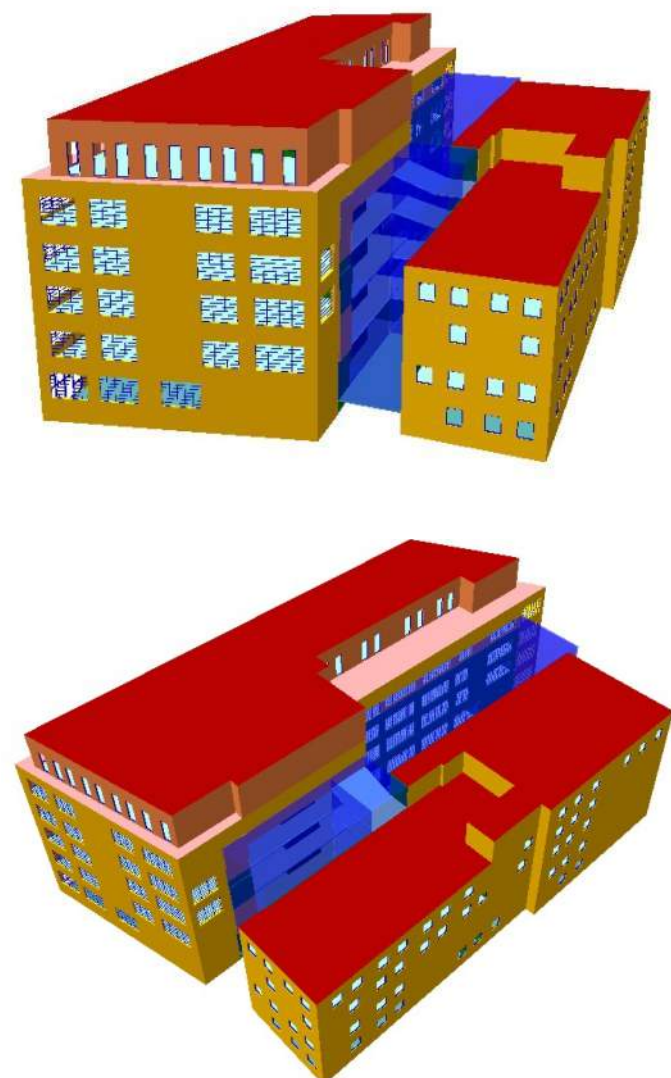
Image of Tas model geometry

Energy Performance Parameters

The following energy performance parameters were inputted into the Tas models.

The existing building's parameters are provided for information only as this did not need to be modelled as part of the Part L calculations.

It should be noted that some performance parameters for both the Part L2B compliant and proposed specification models have been updated since the previous modelling design review.



Images of Tas model geometry

Block A – Existing Building (for information only)

- External wall U-value: 2.0 W/m².K
- Ground and exposed floors U-value: 0.40 W/m².K
- Roof U-value: 1.50 W/m².K
- Window U-value: 5.0 W/m².K
- Window g-value: 0.81
- Air permeability rate: 25 m³/h/m² at 50 Pa (assumed)
- Lighting efficiency: 45 luminaire lumens per circuit watt
- Boiler efficiency: 75%
- DHW distribution efficiency: 75%
- Space heating distribution efficiency: 75%
- Extract only system SFP (WCs only): 0.5W/l/s
- All other spaces naturally ventilated

Block A – Minimum Interventions (Part L2B Compliant)

- Existing external wall U-value: 2.0 W/m².K
- New external wall U-value: 0.28 W/m².K
- Ground and exposed floors U-value: 0.40 W/m².K
- Existing roof U-value: 1.50 W/m².K
- New roof U-value: 0.18 W/m².K
- Upgraded window U-value: 1.8 W/m².K
- Upgraded window g-value: 0.58
- Air permeability rate: 25 m³/h/m² at 50 Pa (assumed)
- Lighting efficiency: 45 luminaire lumens per circuit watt
- DHW boiler efficiency: 84%
- DHW distribution efficiency: 75%
- VRF Space Heating / Cooling (SCOP/SEER): 2.0 / 2.6
- Extract only system SFP (WCs only): 0.5W/l/s
- All other spaces naturally ventilated

Note: New or replaced building building elements meet the required minimum U-values of Part L2B 2010. Proposed plant and building services comply with the minimum requirements of the *Non-domestic Building Services Compliance Guide 2013* for existing buildings.

Block A – Refurbishment Proposals + New Build Extension

- External wall U-value: 0.25 W/m².K
- Ground and exposed floors U-value: 0.40 W/m².K
- Roof U-value: 0.15 W/m².K
- Window U-value:
 - North: 1.2 W/m².K (triple-glazed windows)
 - South: 1.8 W/m².K (double-glazed windows)
- Glazing g-value: 0.58
- Atrium Curtain Walling U-value: 2.0 W/m².K
- Air permeability rate: 10 m³/h/m² at 50 Pa for refurbishment and 5 m³/h/m² at 50 Pa for the new-build extension
- Lighting efficiency: 60 luminaire lumens per circuit watt in all areas
- Lighting controls: Photocell daylight dimming in offices and PIR occupancy control in WC areas
- DHW boiler efficiency: 91%
- DHW distribution efficiency: 85%
- VRF Space Heating / Cooling (SCOP/SEER): 3.5 / 4.0
- Mechanical Ventilation with Heat Recovery (MVHR) system, Specific Fan Power (SFP): 1.5W/l/s
- MVHR heat recovery efficiency: 70%
- Extract only system SFP (WCs only): 0.3W/l/s

Results

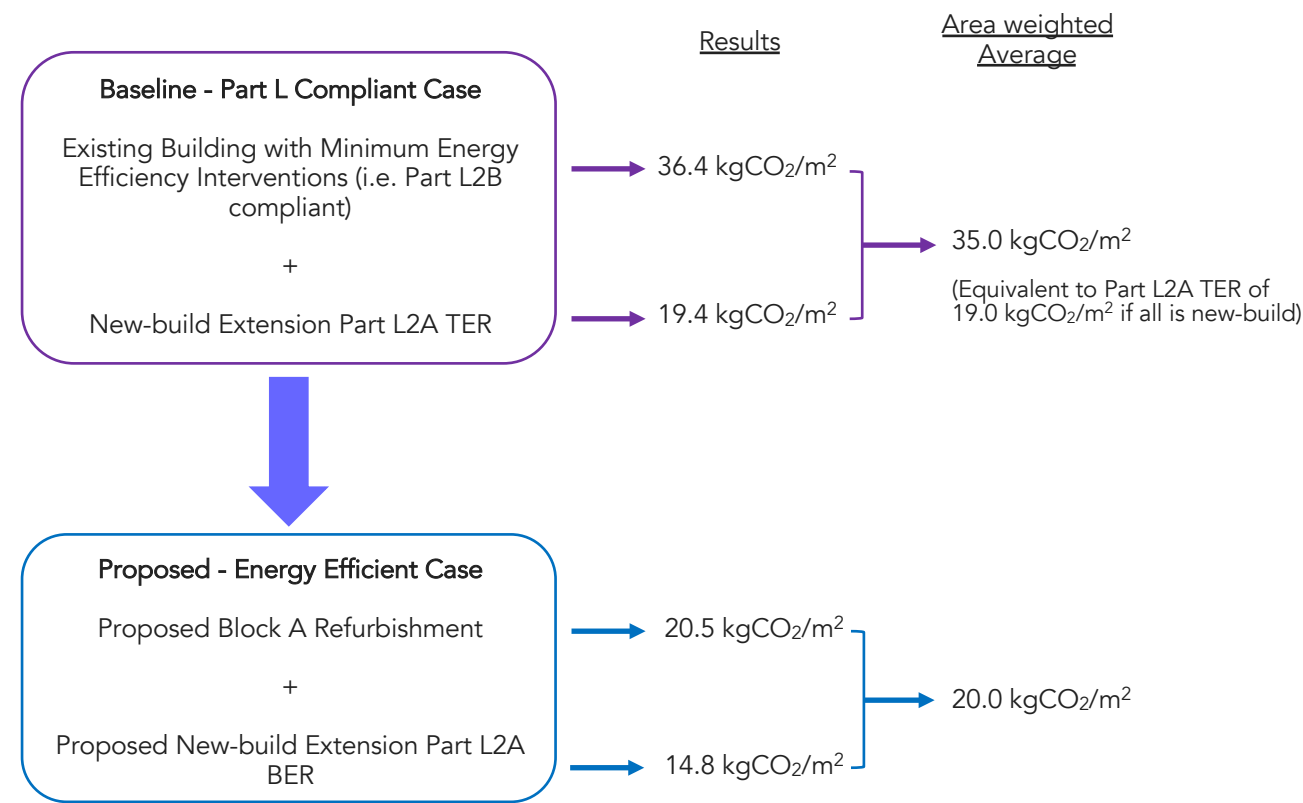
The modelling results provide the calculated CO₂ emissions of the existing Block A building and for the new-build extension.

For the existing building two have been modelled, these are:

- 1) the minimum standards required by Part L2B, and
- 2) the proposed refurbishment specification.

The new-build extension was modelled under Part L2A, which provided both a BER and TER figure. Assuming that the results from the existing building that was modelled using the minimum Part L1B parameters is equivalent to a TER for the refurbished building, an overall TER figures was created by averaging this and the extension’s TER.

It can be seen from the results that the proposed refurbishment specification is calculated to have regulated CO₂ emissions that are **43.7%** lower than the minimum Part L2B specified building, whilst the new-build extension achieves a **23.7%** CO₂ reduction over its Part L2A TER. Overall this is equivalent to a **42.8%** reduction in regulated CO₂ emissions on an area-weighted average basis compared to the aggregated target rating.



Summary of results – Calculated CO₂ emission rates

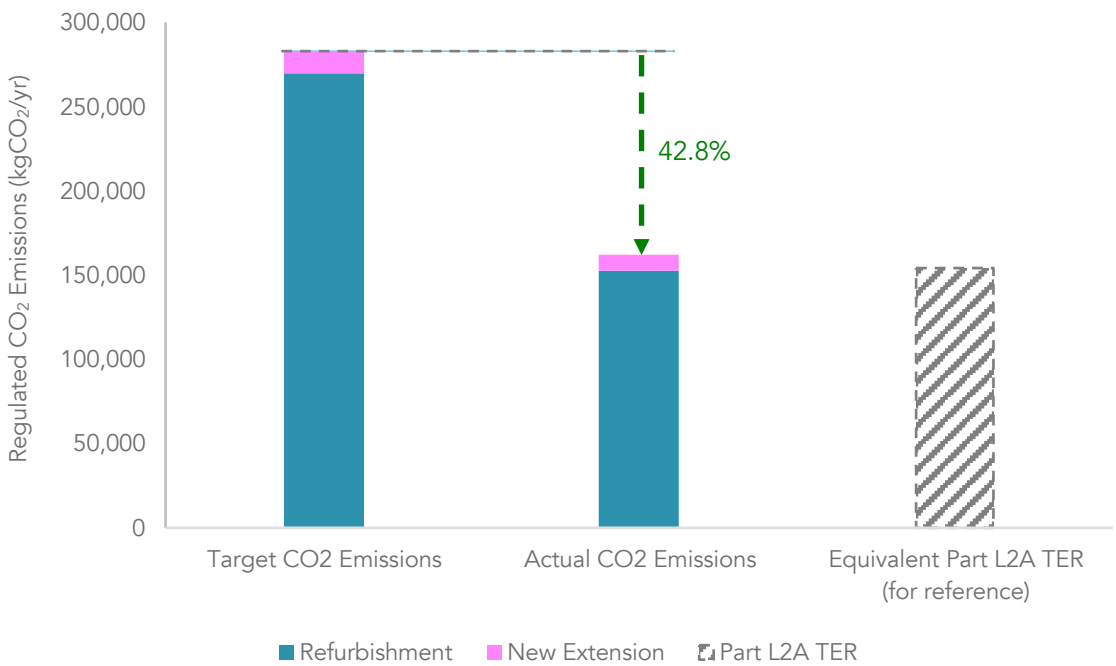
	Calculated CO ₂ Emissions Rate / BER (kgCO ₂ /m ² .yr)	Part L2A TER (kgCO ₂ /m ² .yr)	Conditioned Floor Area of Model*
Existing Building with Minimum Energy Efficiency Interventions (Part L2B Compliant)	36.4	N/A	7,427m ²
New-Build Extension	14.8	19.4	658m ²
Proposed Existing Building Refurbishment	20.5	(19 if new-build**)	7,427m ²

* Note that the model floor area may differ slightly from the actual floor area due to modelling methodology conventions and tolerances.

** For information only: Calculated TER if the proposed refurbishment was being assessed under Part L2A.

Summary of results – Calculated CO₂ emission reductions

	Target CO ₂ Emissions (kgCO ₂ /yr)	Actual CO ₂ Emissions (kgCO ₂ /yr)	CO ₂ Reduction
Existing Building / Refurbishment	270,343	152,253	43.7%
New-Build Extension	12,765	9,738	23.7%
Total	283,108	161,991	42.8%



Appendix 1

External Wall Insulation and Window Design Information

Summary

Option B2 assessed the use of external wall insulation, which is not included in the current architectural scheme.

This would affect the appearance of the building and external detailing.

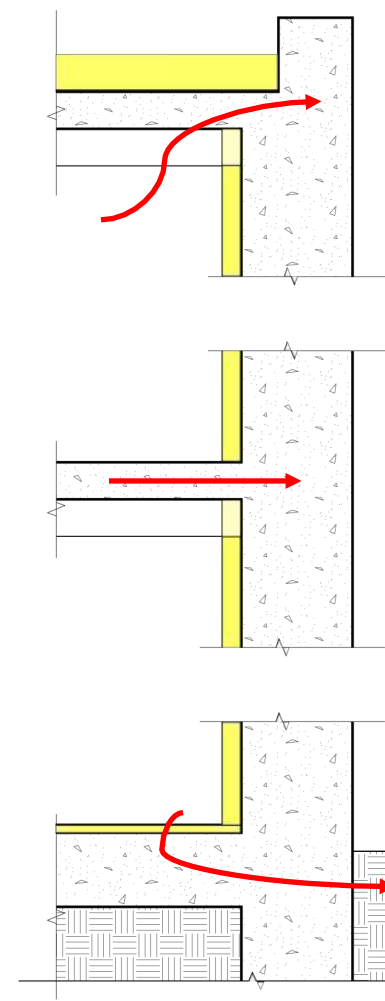
There is a strong practical energy performance case for externally insulating the existing Block A building at The Chocolate Factory. It is a simpler approach to renovation in keeping with the existing construction of the building. An external insulation strategy enables large actual improvements in thermal performance whilst adding protection to the existing structure.

However, it was not considered desirable.

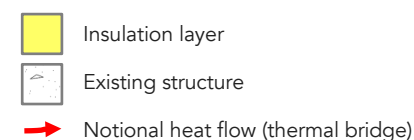
Detail

The two diagrams and explanations opposite compare the two possible approaches to improving the thermal elements of the building.

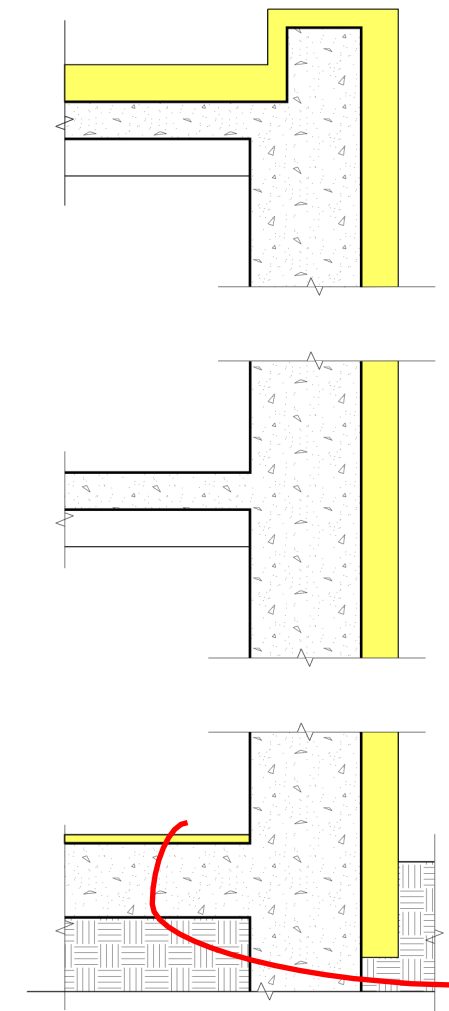
Internal insulation



Notional section of building showing internal insulation and thermal bridges.



- The actual average U-value of the wall is significantly worse than the calculated typical insulation value due to repeat thermal bridging heat loss through structural elements.
- The insulation increases the risk of interstitial condensation occurring in the wall construction. The best U-value possible is limited by this risk to a recommended value of no more than $0.30\text{W/m}^2\text{K}^*$.
- All new and existing structural elements connected to the external walls will be significant thermal bridges. New steel connections must be thermally broken.
- All internal services need to be removed and all internal floor and wall connections need to be dressed up to and sealed to the insulation.
- The thermal mass is isolated outside the conditioned space and has limited effect on reducing cooling demand.
- The internal wall surface is less robust. Future connections and changes in layout effect the fabric performance of the building.
- Loss of internal 'character' to the workspaces. Exposed internal brickwork would not be possible on outside walls as it would be covered by insulation and internal finishes.



Notional section of building showing continuous external insulation.

External insulation

- The improvement in performance and reduction of carbon emissions for the same thickness of insulation is improved. Heat loss from thermal bridging is greatly reduced.
- Structural connections can be made directly to the existing structure with no penalty to thermal performance and with no additional detailing.
- The external insulation and render protect the existing structural frame.
- The thermal mass of the building is retained inside the heated space and contributes to reducing summer overheating.
- Coloured render systems can be used with a longer lifespan than other paints or coatings.
- Render systems can follow the existing profile and wall finish/texture of the building to reduce the visual impact of the over-cladding, e.g. by matching the repeated recesses and column features.
- The internal surfaces are robust and the internal layout can freely be changed with no effect on the building fabric performance.

* English heritage and STBA Responsible retrofit guidance <http://responsible-retrofit.org> 2016

Context

The existing windows are single glazed with a very high proportion of slender steel frame. This is an attractive and key part of the character of Block A.

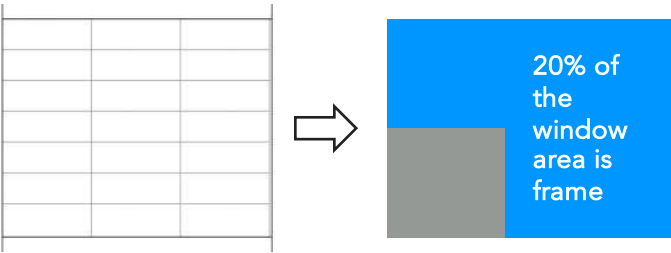
The existing windows unfortunately have very poor thermal performance, high air leakage and will need to be replaced to comply with building regulations approved document Part L2B 2013.

Windows with a similar thin frame and improved thermal properties are available, however these offer substantially reduced performance when compared to good practice modern glazing systems. A key reason for this is the high proportion of frame area; the frame is a weaker thermally.

Additionally due to the thin glazing profiles the air leakage of even new windows of this type is substantially greater than good practice.

Three alternative strategies are proposed. It is recommended that the windows should be replaced with high performance modern windows that do not attempt to match the existing proportions. This is to improve the thermal performance and improve the daylighting into the areas. This strategy has been followed successfully at Workspace ‘The Pill Box’.

It should be noted that in the internal atrium space there would be reduced thermal performance to the windows which may mean it is not necessary to replace them (assuming acoustic performance can be met.)



The existing windows have a very high frame area. The frame is worse performance than the glass and reduces the daylight into the room



	1. Secondary glazing	2. Like for like replacement windows	3. Replacement windows
Characteristics	• New panes inside existing windows. • Works best with internal insulation approach • Large glass panes with minimum frame can be used to minimise appearance.	• Use windows designed to give a similar appearance to the existing, but including double glazing. • Frames match the existing.	• New windows replace the existing and have fewer mullions and transoms and a thicker frame sight line. • Double or triple glazing can be specified. • Much higher performance is available at lower cost.
Advantages	• Retains existing windows especially external appearance • Good improvement to thermal performance and comfort.	• Replicates existing windows internally and externally. • Some improvement to thermal performance and comfort. • Works with internal or external insulation approach.	• Excellent improvement in thermal performance and comfort. • Maximum flexibility in terms of frame and manufacturer choice. • Increased glass area as the proportion of frame can be reduced. • Complete flexibility in locations and sizes of ventilation openings. • Works with internal or external insulation approach.
Restrictions and disadvantages	• Internal appearance is compromised. • Openings for ventilation are limited to the existing windows and restricted further by the additional glass pane. • Existing frame shades and reduces daylight to the room.	• Only minor improvement in frame thermal performance is possible. • Small maximum glazing thickness means thermal performance is limited to poor double glazing. • Ventilation openings could be restricted due to pane size. • Potential high cost of systems to replicate existing windows.	• Existing internal and external appearance is altered

Approach recommended by Etude

PRELIMINARY PART L2A 2013 ASSESSMENT OF BLOCK F

SUMMARY

THE CHOCOLATE FACTORY



ENERGY STRATEGY FOR BLOCK F

February 2018 | Rev C

Introduction

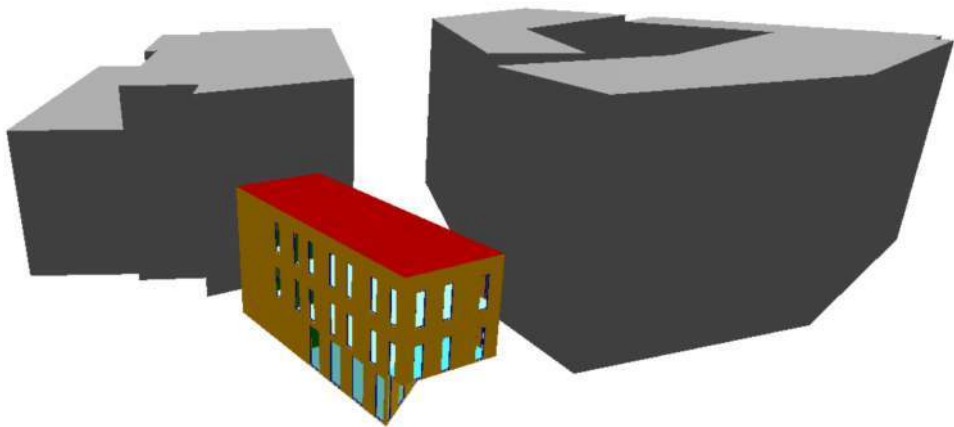
The aim of this document is to summarise the preliminary Part L2A assessment carried out for the proposed Block F of the Chocolate Factory development in Haringey. The first and fundamental step taken towards designing a low carbon building is to consider and maximise opportunities for passive design and energy efficiency. A preliminary dynamic thermal model of the building has been developed using an accredited Part L software (Tas version 9.4.1) to calculate the carbon emissions savings compared to Building Regulations and inform the design development. The key inputs and assumptions used within the model are as follows:

Key modelling input parameters

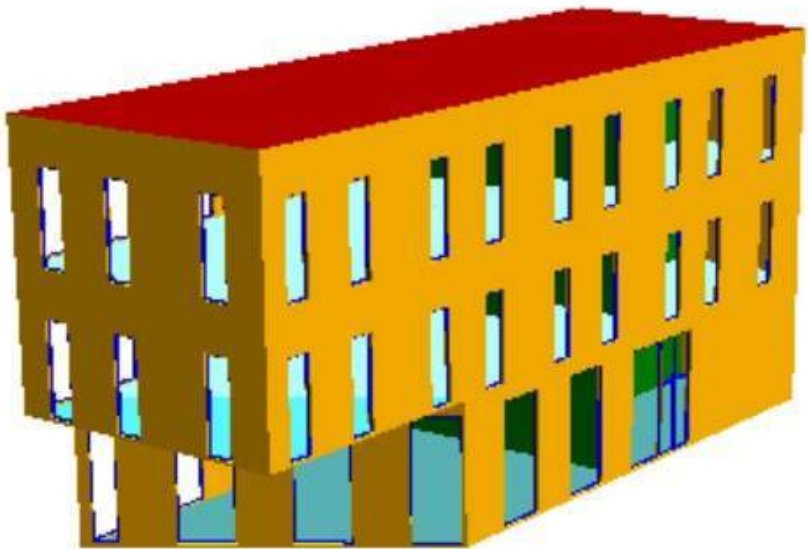
- Window U-value: 1.4 W/m².K (double-glazed windows)
- Glazing g-value: 0.50
- External wall U-value: 0.20 W/m².K
- Ground and exposed floors U-value: 0.15 W/m².K
- Roof U-value: 0.15 W/m².K
- Air permeability rate: 5 m³/h/m² at 50 Pa
- Lighting efficiency: 70 lamp lumens per circuit Watt in office areas, and 60 lamp lumens per circuit watt in all other areas
- Lighting controls: Photocell Daylight Dimming in offices and PIR occupancy control in all areas
- Boiler seasonal efficiency: 92%
- DHW distribution efficiency: 90%
- VRF Space Heating / Cooling (SCOP/SEER): 3.5 / 5.0
- Mechanical Ventilation with Heat Recovery (MVHR) system, Specific Fan Power (SFP): 0.7W/l/s
- MVHR heat recovery efficiency: 80%
- Extract only system SFP (WCs only): 0.5W/l/s

Ventilation and Heating/Cooling Strategy

- Offices and Retail: Mechanically ventilated with VRF heating and cooling
- WCs: Mechanical extract ventilation



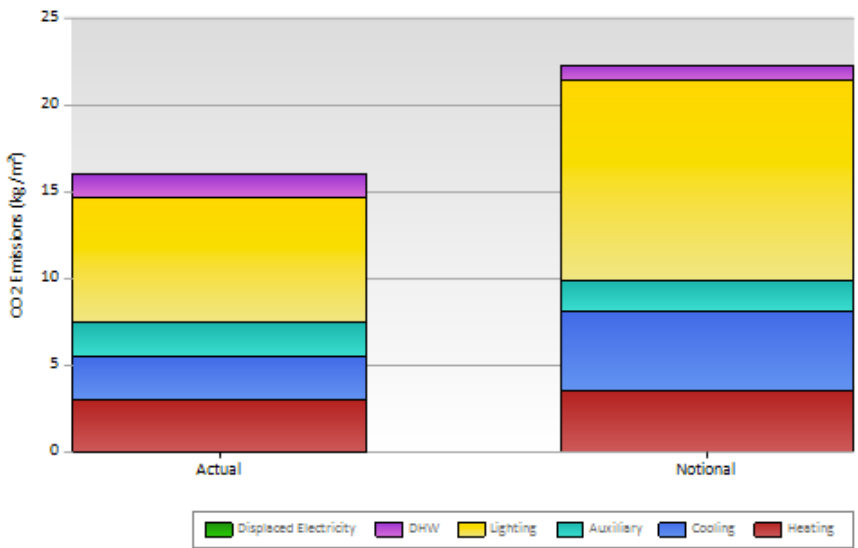
Part L Model in Tas
(Block F)



Part L Model in Tas
(Block F)

Results

The results from the Part L modelling of Block F show that the proposed building is expected to achieve a 26.6% improvement over Part L 2013 prior to the incorporation of any Low or Renewable Technologies.



	Actual	Notional
Heating (kgCO2/m²)	3.03	3.53
Cooling (kgCO2/m²)	2.53	4.61
Auxiliary (kgCO2/m²)	1.99	1.78
Lighting (kgCO2/m²)	7.18	11.48
DHW (kgCO2/m²)	1.33	0.94
Displaced Electricity (kgCO2/m²)	0.00	0.00
Equipment (kgCO2/m²) *	16.42	16.01
Total (kgCO2/m²)	16.05	22.35
Total Floor Area (m²)	706.40	706.40

DETAILED RESIDENTIAL OVERHEATING RISK ASSESSMENT RESULTS

THE CHOCOLATE FACTORY



SUMMARY OF OVERHEATING RISK ASSESSMENT

February 2018 | Rev C

Mitigating overheating

New dwellings at the Chocolate Factory will be very energy efficient and in particular very air-tight, representing best practice design in terms of low carbon design. They will also achieve good levels of daylight. It is crucial that these objectives are not achieved at the expense of comfort and in particular that it does not lead to critical overheating issues.

Why should we worry about overheating?

There were over 2,000 excess deaths during the ten-day heat wave in August 2003 across England and Wales and it is widely predicted that climate change will lead to more frequent and intense heat waves, as well as increases in average temperatures. Eight of the UK's top-ten warmest years have happened since 2002 (Source: *Met Office 2015*).

Combined with increased urbanisation and an ageing population, thousands more people are expected to be affected by heat-related ill health by 2050, particularly elderly and vulnerable people.

Overheating can also cause less critical health problems. Sleep deprivation for example. Research indicates that heat-related sleep loss is a cause for concern.

There are a growing number of publications on overheating in homes, particularly by the Zero Carbon Hub.

What are the key thresholds for overheating?

Research suggests that normally people can cope with a resting temperature of 37°C (World Health Organization 2004a). However, there is only limited and indirect epidemiological evidence about the indoor temperature exposure conditions which would cause adverse health impacts. There is therefore currently no formal cross-sectoral agreement on the temperature thresholds for 'overheating' in homes above which adverse health impacts occur. Most definitions and thresholds have been developed with thermal comfort in mind rather than specific health impact trigger points.

CIBSE's Environmental Design Guide A (CIBSE 2006) definition for dwellings stated that operative temperatures:

- should not exceed 28°C for 1% of annual occupied hours in living areas,
- should not exceed 26°C for 1% of annual occupied hours in bedrooms.

However, this latter definition was considered insufficient by researchers. CIBSE Technical Memorandum 59: *Design methodology for the assessment of overheating risk in homes* has been published recently and suggests a more thorough assessment of overheating which has been adopted for the Chocolate Factory.

An important difference between CIBSE Guide A and TM59 is that the latter is based on the concept of 'adaptive comfort': instead of setting an absolute 'maximum' temperature throughout the summer, it sets a dynamic limiting

temperature which varies depending on the external temperature, as it is acknowledged that an occupant's sense of comfort varies.

It should however be noted that TM59 is in its infancy, and is only representative of projected summer conditions modelled. The intent of this analysis is to show whether there is an increased risk of overheating, and does not intend to suggest the scheme will or will not overheat. The two requirements which must be achieved in order to pass the risk assessment are as follows:

All habitable rooms must meet the following criterion:

Criterion 1: Hours of Exceedance (H_e)
The number of hours (H_e) during which the internal temperature exceeds the TM59 limiting temperature by one degree (°C) or more during May to September inclusive must not be greater than 3% of occupied hours.

All bedrooms must also meet the following criterion:

Criterion 2: Comfort during the sleeping hours
The resultant temperature in the bedroom from 10pm to 7am cannot exceed 26°C for more than 1% of hours. (1% of hours between 2200-0700 for bedrooms is 32 hours annually).



The Chocolate Factory | Energy Statement | Overheating risk assessment



What are the main causes of overheating and how to reduce this risk?

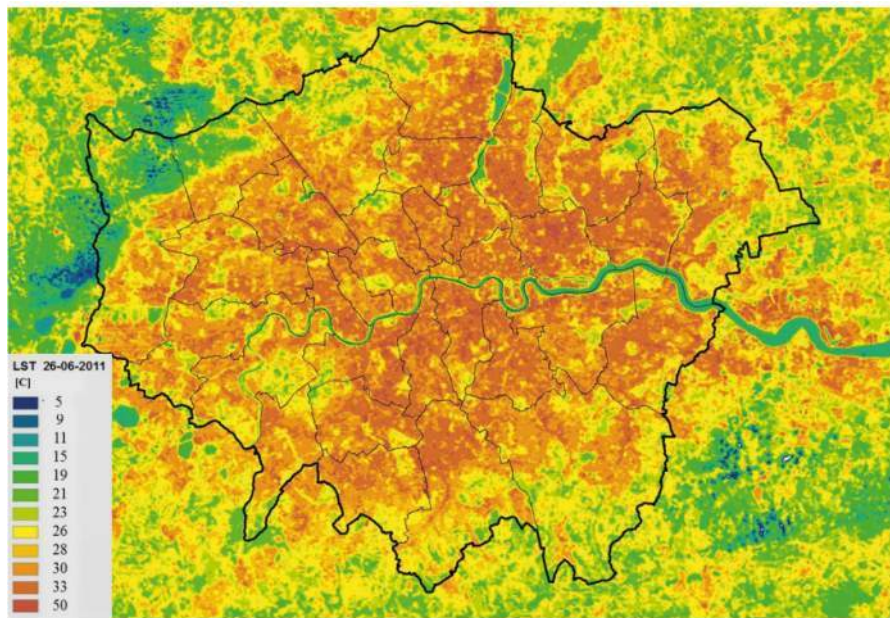
The main causes of overheating can be split up into four categories: those associated with the site, those associated with architectural design, those associated with building services design and finally those associated with occupants.

Site issues

The **external air temperature** has a significant impact on the risk of overheating and it is therefore important that the public realm design seeks to minimise the heat urban heat island effect (e.g. hard surfaces absorbing heat during the day and releasing it at night).

Areas of the site with significant hard landscape coverage will be improved with trees and other green elements which will either reduce solar radiation on the ground or minimise its effects. Large canopy deciduous trees will also be provided along streets and in the public realm and green roofs on top of buildings to provide shade and evaporative transpiration.

In the public realm, lighter coloured materials will be favoured as they have a higher solar reflection coefficient and will help to reduce heat absorption and therefore surface temperatures.



Greater London measured Land Surface Temperatures
(° C) – day time 26th June 2011 (© Arup 2014)

The **acoustic conditions** are often the single most important factor: a very noisy outside environment may prevent or discourage residents from opening their windows (particularly at night) therefore dissipating the heat in their homes. Waterman, the acoustic engineers, have confirmed that it is satisfactory to assume that occupants will be able to open windows at their own discretion.

Poor local air quality could also prevent occupants from opening their windows. However local air quality is not expected to be such a critical issue that it would require the facades to be 'sealed'.

Architectural design issues

Thermal mass helps to 'store' heat and release it later in the day, thereby smoothing internal temperature variation and reducing peaks. For the residential element of the Chocolate Factory, a heavyweight construction system is proposed (i.e. concrete frame). This adds significant thermal mass to the building, and helps to temper sharp changes in temperature.

Ventilation is the most effective means to reduce overheating. It is therefore critical that residents are provided with the means to ventilate all habitable rooms to a level which is sufficient to dissipate heat. Although the MVHR unit will provide a background ventilation rate, it will not be sized to provide enough air to mitigate overheating: windows or openable vents are therefore the first means of ventilation. It is assumed that all windows will be able to open significantly in order to create a large 'free area' for air to come into / leave the apartment. Generous openings in single aspect units are particularly important.

A free area of 80% of the whole window area is targeted for all openable windows (top pane of windows), except where security considerations prevent this strategy. On ground and first floors it is assumed that the windows would only have a free area opening of 10%.

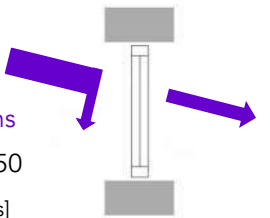
Solar gains are beneficial in the winter as they contribute to reducing heating demand but excessive solar gains are one of the main causes of overheating.

Excessive unprotected glazed areas facing South-East to West should be avoided and large glazed areas facing South should be adequately protected from excessive solar gains. This comment applies particularly to top floors which already suffer from increased solar gains through the roof and reduced shading from adjacent buildings.

External shading (e.g. balconies, brise-soleils, movable shutters) is much more efficient at reducing overheating than internal blinds or curtains. However, in the absence of external shading internal blinds are highly recommended.

Solar coating on glazing should be avoided if possible on residential properties as it would affect energy efficiency negatively. A g-value of 0.50 is currently assumed for the residential units.

All elevations
g-value = 0.50
[without blinds]



Building services design issues

District heating secondary distribution networks: reducing horizontal distribution of secondary district heating pipes (number and lengths) and ensuring that they are continuously insulated not only helps to reduce energy losses but also overheating. As these pipes run at temperatures comprised between 40°C and 80°C it also prevents heat build up in circulation spaces particularly corridors.

Ventilation of corridors: ventilation means should be provided to internal corridors to reduce the risk of overheating even further. Windows in corridors should be openable, and where corridors are landlocked, means of adequate ventilation should be provided.

Heat interface units: very often the heat interface unit in each dwelling are poorly insulated and act as small radiators throughout the year. It is critical to ensure that heat interface units are well and completely insulated.

MVHR design (summer bypass): MVHR systems should be selected with a 'summer bypass mode' so that incoming air is not pre-heated by the heat exchanger in summer. The MVHR control panel will need to highlight to the occupant the need for a switch over during the summer. A summer boost flow rate should be possible enabling occupants to increase the background mechanical ventilation flow rate.

Local hotspots: heat rejection equipment from non-residential spaces should not be located near a residential unit at risk of overheating.

Occupancy/behavior issues

Beyond issues which can be influenced by Workspace, the overheating risk can also be influenced by a number of factors associated with occupancy and behavior.

Firstly, a key risk factor is the occupancy pattern of the residential unit. More vulnerable people (young children, elderly residents) are more likely to remain at home for very long spells, particularly during hot weather. Additionally, home working, encouraged with home office provisions, may result in more people being at home during day time hours. Secondly, the use of appliances at home can add to the internal gains and aggravate the overheating risk.

Proposed assessment tools

Three tools have been used to assess the risk of overheating at the Chocolate Factory.

A sample of 43 residential units (approx. 20% of the total number) has been tested using SAP and a sample of non-residential units has been tested against Part L2A 2013 Criterion 3 using an accredited Part L2A software, in line with the requirements of the Building Regulations – These two tests check **compliance with mandatory overheating / solar gain reduction requirements**.

Key residential units (3% of the total number, i.e. approximately 7 units across the 3 residential blocks) have been tested using a Dynamic Simulation Tool (EDSL Tas v9.4.1). This test will lead to a **detailed overheating risk assessment**.

In summary, the three methodologies used to assess the risk of overheating at the Chocolate Factory are:

- COMPLIANCE (residential): SAP overheating test
- COMPLIANCE (non-residential): Part L2A 2013 Criterion 3
- DETAILED ASSESSMENT (residential only): CIBSE TM59

Comment on the size of sample to be tested using a Dynamic Simulation Tool

The apartments selected show a clear range of typologies which are representative of the scheme, and are considered to be a robust assessment of the profile of risk to overheating.

The sample of apartments selected as part of the detailed analysis have been chosen to reflect a balance of worst case apartments with more typical apartments. The reasoning for this is to showcase the development as a whole, and not to misrepresent how the development fares in terms of an overheating risk. This prevents very conservative design being applied to all dwellings when the likelihood is that most dwellings are not at risk.

Compliance

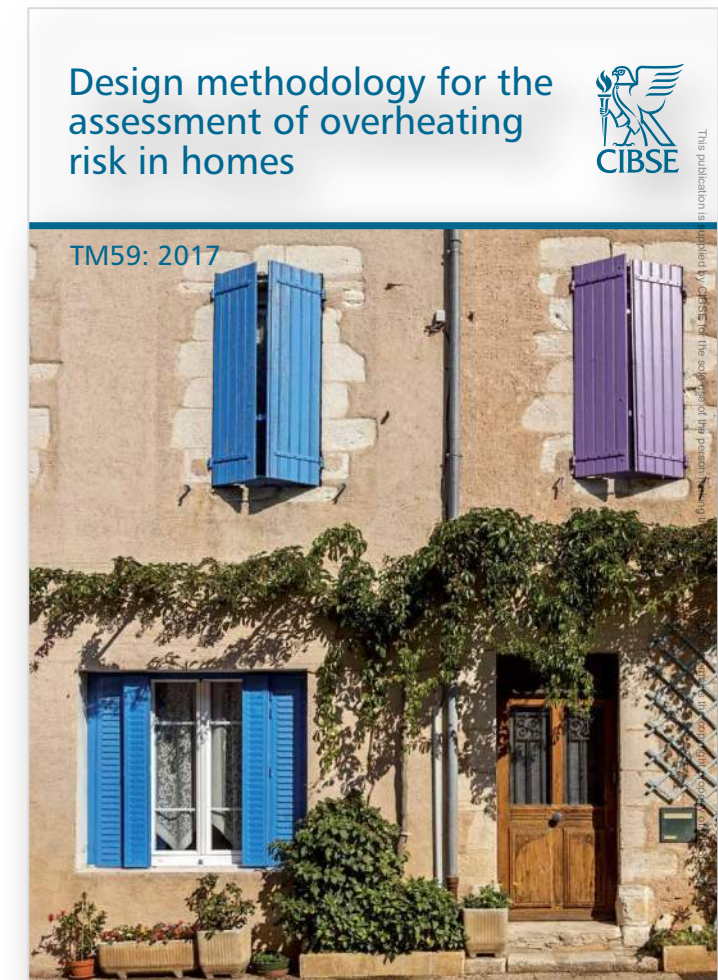
SAP is used to assess compliance with Building Regulations Approved Document Part L1A 2013 including Criterion 3: Limiting the effects of heat gains in summer. SAP Appendix P *Assessment of internal temperature in summer* provides a method for demonstrating compliance with Criterion 3. It is a simplified test that uses standard internal heat gains and profiles for occupancy, equipment and lighting, which cannot be adjusted by the user.

The overheating assessment consists of a single 'static' calculation for each month of June, July and August using monthly average weather data for the location and produces a single predicted average internal temperature for each month. This temperature is then compared to a 'threshold temperature' in order to determine the risk of overheating for each month. The overheating risk is categorised as being either 'high', 'medium', 'slight' or 'low'. Where the resulting mean internal temperature is greater than 23.5C, a high risk of overheating is predicted, where the temperature is between 22C and 23.5C, a medium risk is predicted and for a temperature between 20.5C and 22.0C, a slight risk is predicted. For compliance purposes, a medium or lower risk of overheating is normally deemed acceptable. This method of determining overheating risk does not take into account the magnitude of peaks in external temperature or the duration of warm spells.

This 'simple' overheating test has been undertaken for a sample of 43 units tested against SAP pre-planning (i.e. approx. 20% of all units) and will be undertaken for all units tested against SAP during detailed design.

Part L2A 2013 Criterion 3 deals with the limitation of solar gains in summer for non-domestic buildings. It places a limit on solar gain only and does not assess the temperature in a space. The solar gains in each zone of the thermal model created are compared to the 'limiting gains' for that zone.

This 'simple' solar gain test has been undertaken for all non-residential spaces (Block A and Block F) at pre-planning and then again during detailed design.



Detailed risk assessment

The current methodology for the assessment of overheating in homes suggests the Design Summer Years (DSY) should be used for analysis of overheating, taking into account future weather files (TM48 and TM49).

According to the TM 59 guidelines, the dwellings must be evaluated using the DSY1 file (for example 1989 for London) most appropriate for the site location, for the 2020s, high emissions, 50% percentile scenario.

The guidance suggests that further tests using more extreme DSY2 and DSY3 files as well as future files can be used to further test designs of particular concern or per client brief and for demonstrating mitigation options under more extreme events (e.g. heatwaves). A pass using these weather files however is not mandatory.

- The three London weather files included in the analysis that represent a range of potential warm summer scenarios are:
- 1989: (DSY 1) a moderately warm summer (current DSY for London) (main)
 - 2003: (DSY 2) a year with a very intense single warm spell. (optional)
 - 1976: (DSY 3) a year with prolonged period of sustained warmth (optional)

As the site is in Wood Green, the London Weather Centre location was selected. This weather location is required to be used in all urban London sites, and is considered as the worst case scenario in terms of the temperature profile.

Summary of Weather data used in the analysis

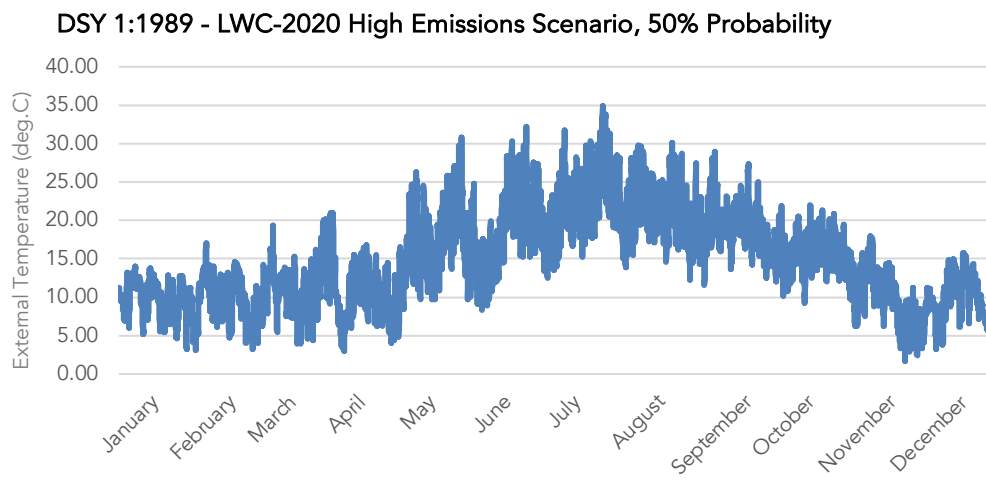
Between the changes to the methodology (CIBSE Guide A -> TM59), weather data based on the GLA Guidance and TM49 (1 weather data set -> 3 weather data sets) has been used. Each habitable room of each apartment tested now needs to be tested against the TM59 criterion using the DSY 1 weather data set shown on this page.

In addition, dwellings have been tested against different summer scenarios,

- DSY 2 – A short, intense warm spell; and
- DSY 3 – A long, less intense warm spell.

The purpose of using these weather files shows how the rooms are likely to perform in those more extreme circumstances.

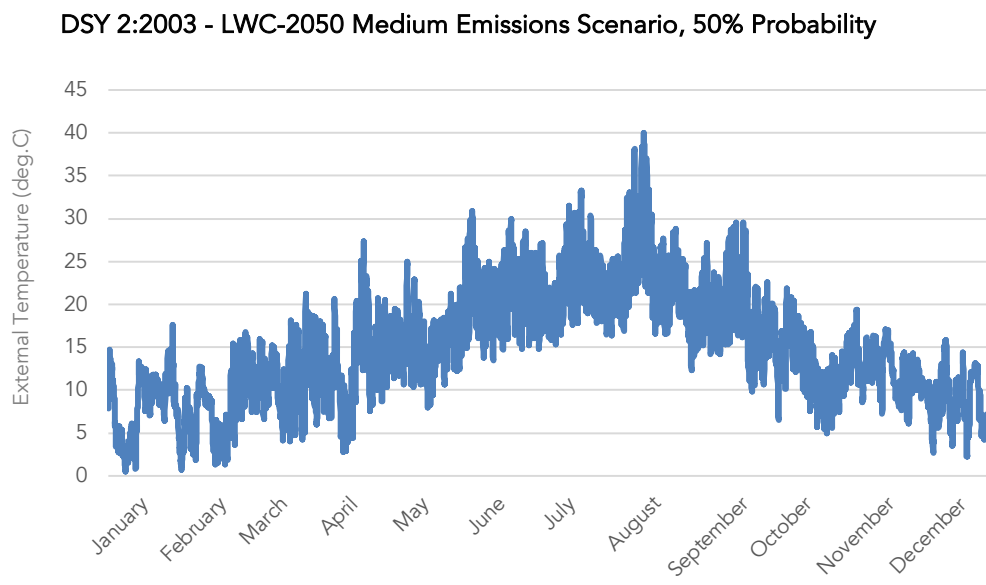
Comparison of Weather Data Files



DSY 1 - Summary of Weather file

Peak External Temperature:	34.9	deg.C
Average External Temperature:	14.8	deg.C

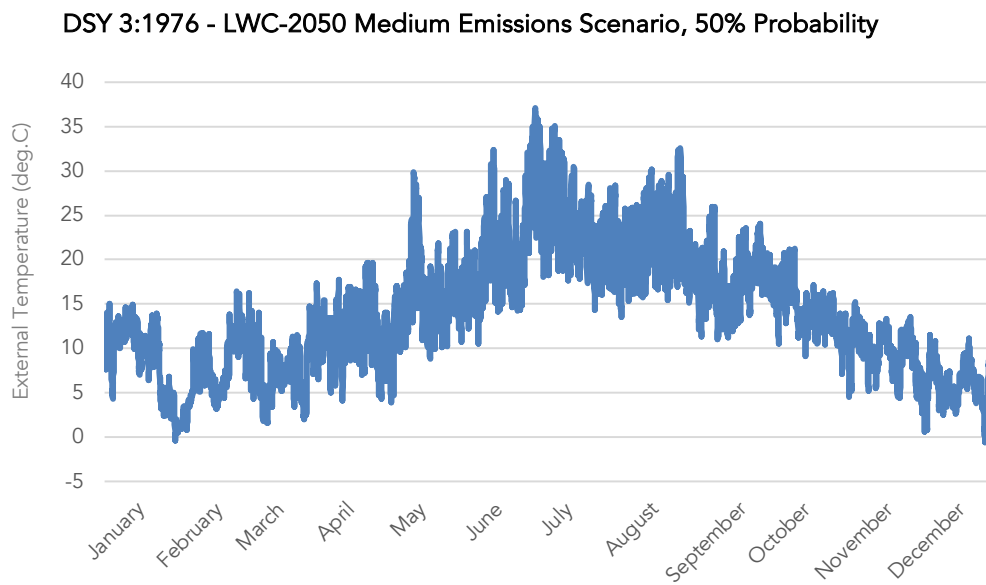
This weather file is recognised as having a **moderately warm summer**, and all residential elements assessed using the current methodology for the assessment of overheating in homes must meet the thermal comfort criteria.



DSY 2 - Summary of Weather file

Peak External Temperature:	40.0	deg.C
Average External Temperature:	14.7	deg.C

This weather file is recognised as having a **short, intense warm spell** during the summer period. The residential elements are tested against this weather file as part of the best practice guidelines proposed in the current methodology for the assessment of overheating in homes.



DSY 3 - Summary of Weather file

Peak External Temperature:	37.1	deg.C
Average External Temperature:	13.9	deg.C

This weather file is recognised as having a **long, less intense warm spell** during the summer period. The residential elements are tested against this weather file as part of the best practice guidelines proposed in the current methodology for the assessment of overheating in homes.

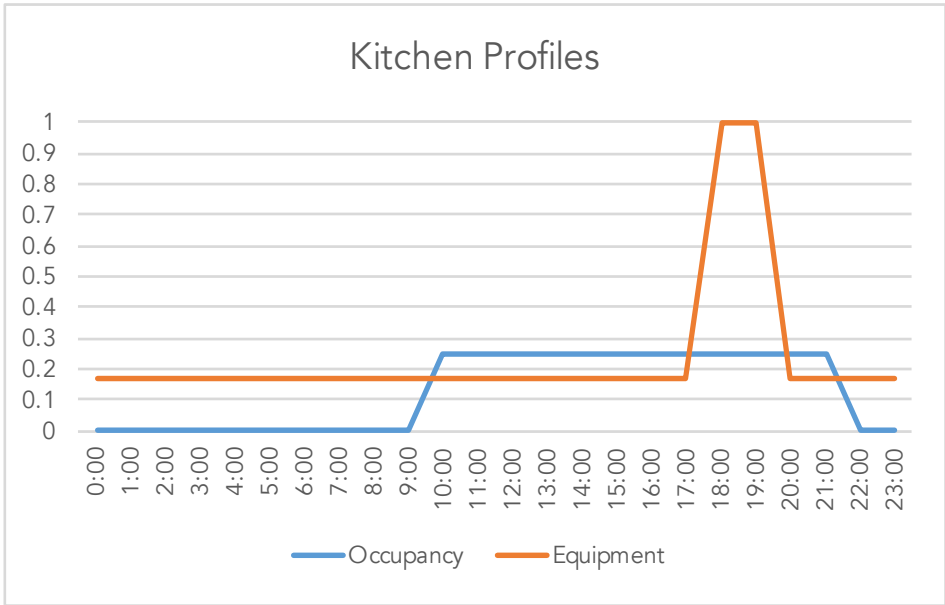
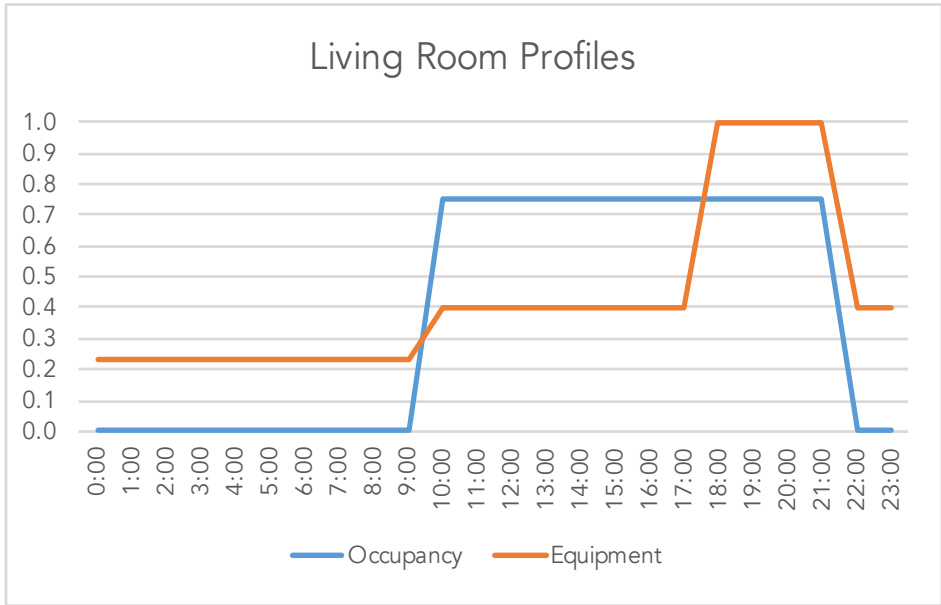
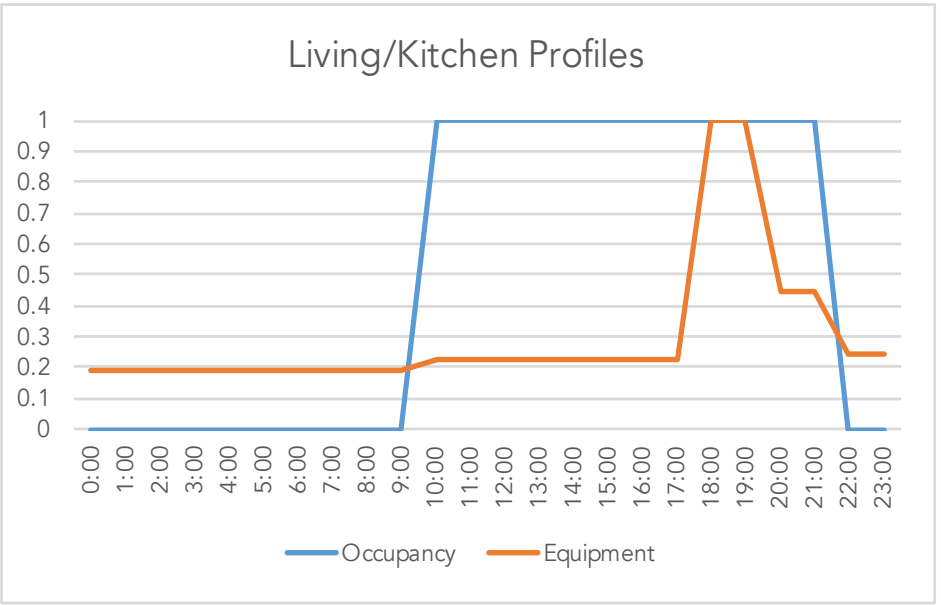
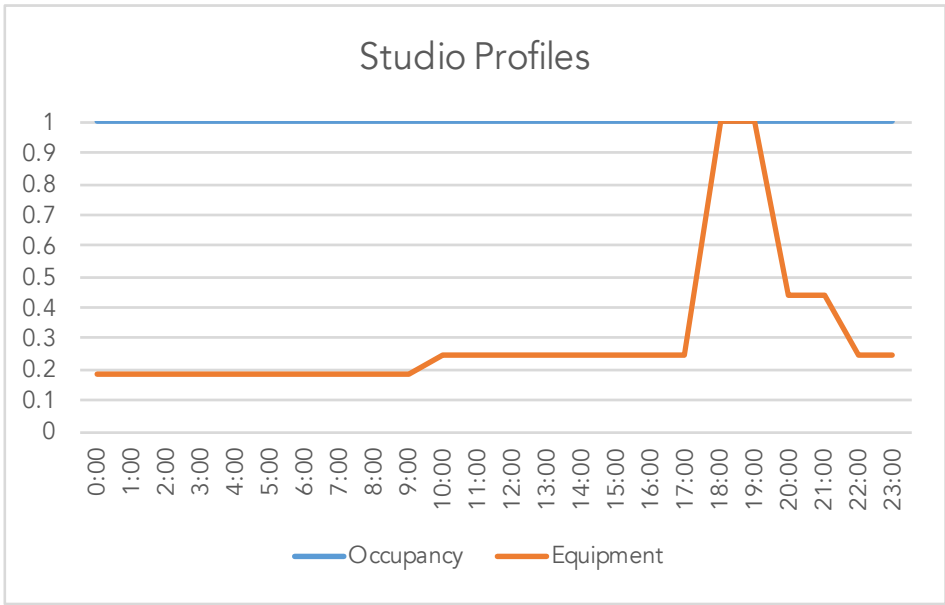
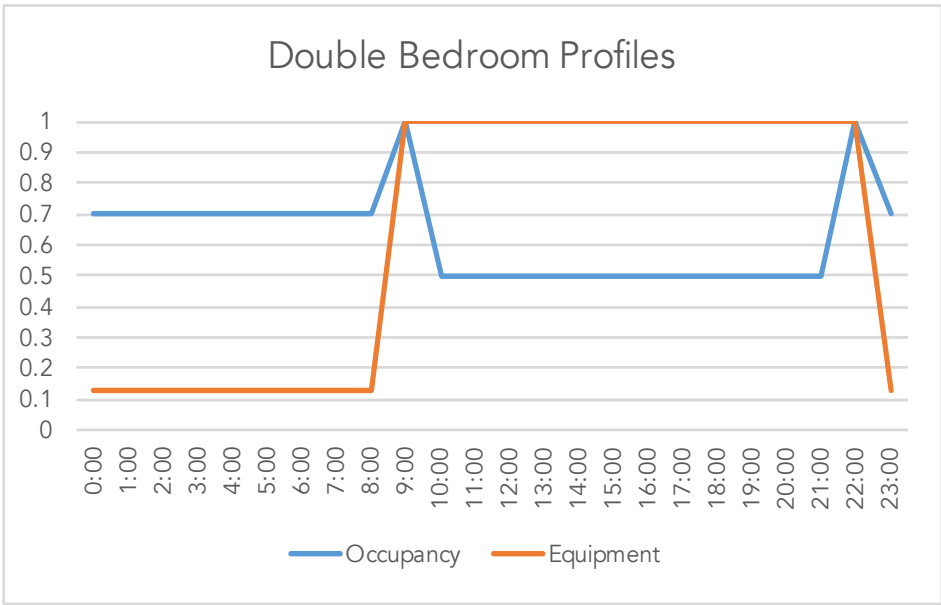
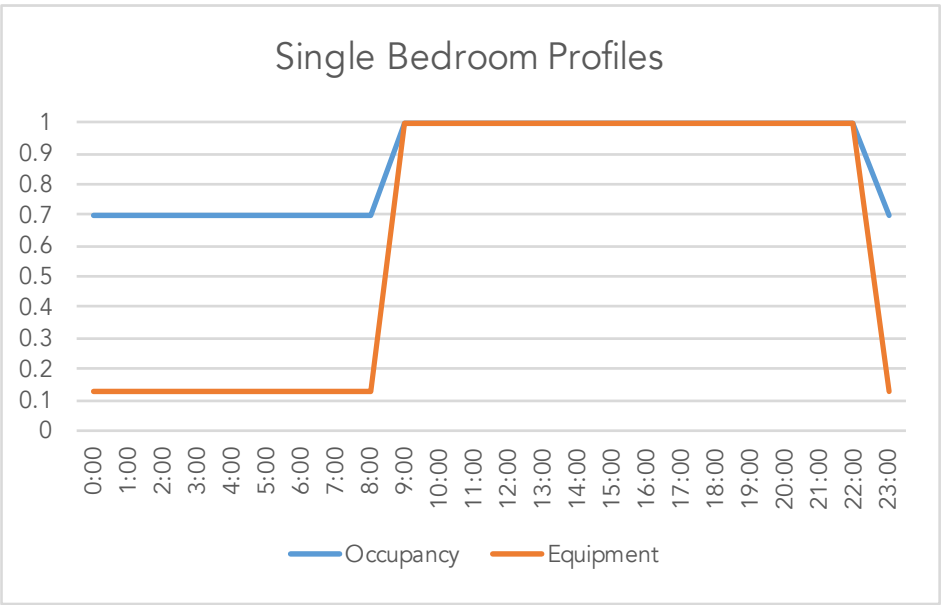
Occupancy and Equipment Profiles

In order to assess the risk of overheating, a series of assumptions regarding how each room will be used throughout the day must be made. The images below show the profiles for both the occupancy (people) in the room, and the equipment use expected in line with the CIBSE residential overheating guidance.

These profiles have been applied to the peak occupancy and equipment load for each room summarised in the adjacent table.

Table: Assumed Occupancy and Equipment loads in each room

	Single Bedroom	Double Bedroom	Studio Apartment	1 Bed Living / Kitchen	1 Bed Living Room	1 Bed Kitchen	2 Bed Living / Kitchen	2 Bed Living Room	2 Bed Kitchen	3 Bed Living / Kitchen	3 Bed Living Room	3 Bed Kitchen
Occupancy	1 Person (130W)	2 People (260W)	2 People (260W)	1 Person (130W)	1 Person (130W)	1 Person (130W)	2 People (260W)	2 People (260W)	2 People (260W)	3 People (390W)	3 People (390W)	3 People (390W)
Equipment	80W	80W	450W	450W	150W	300W	450W	150W	300W	450W	150W	300W



Baseline assumptions

The list below details the assumptions applied to the model.

EDSL Tas (version 9.4.1) has been used to undertake the analysis.

Below are a list of the key assumptions used in the model.

- **Envelope parameters**

Concrete frame

External Wall U-value: $0.20 \text{ W/m}^2\text{K}$

Roof U-value: $0.15 \text{ W/m}^2\text{K}$

Party wall: fully filled cavity or solid wall (i.e. no heat loss)

Window U-value: $1.4 \text{ W/m}^2\text{K}$ (double glazing)

Window glass g-value: 0.50 on all elevations

Frame proportion: 25%

Air permeability rate: $3 \text{ m}^3/\text{h/m}^2$ at 50 Pa considered to be equivalent to 0.25 ach

- **Mechanical ventilation**

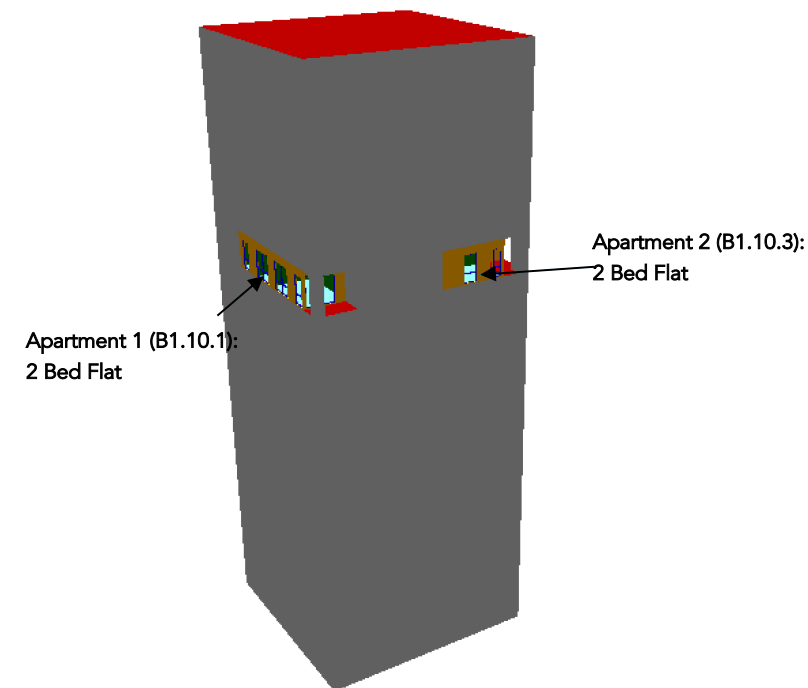
MVHR – Summer boost: 50l/s per flat

- **Lighting Gains:**

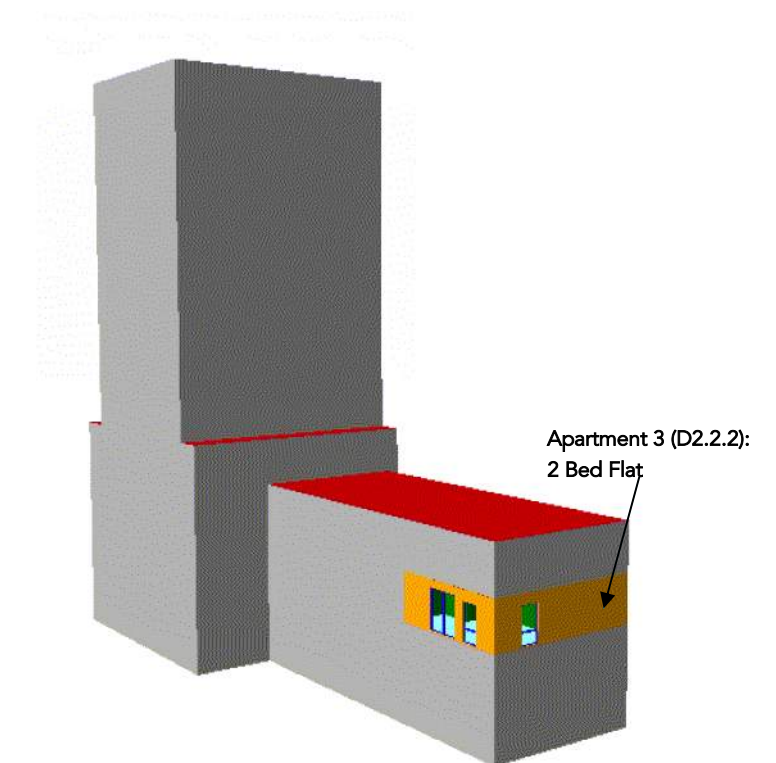
Lighting Gains: 2 W/m^2 in all rooms between 7pm-11pm.

3D images of apartments modelled

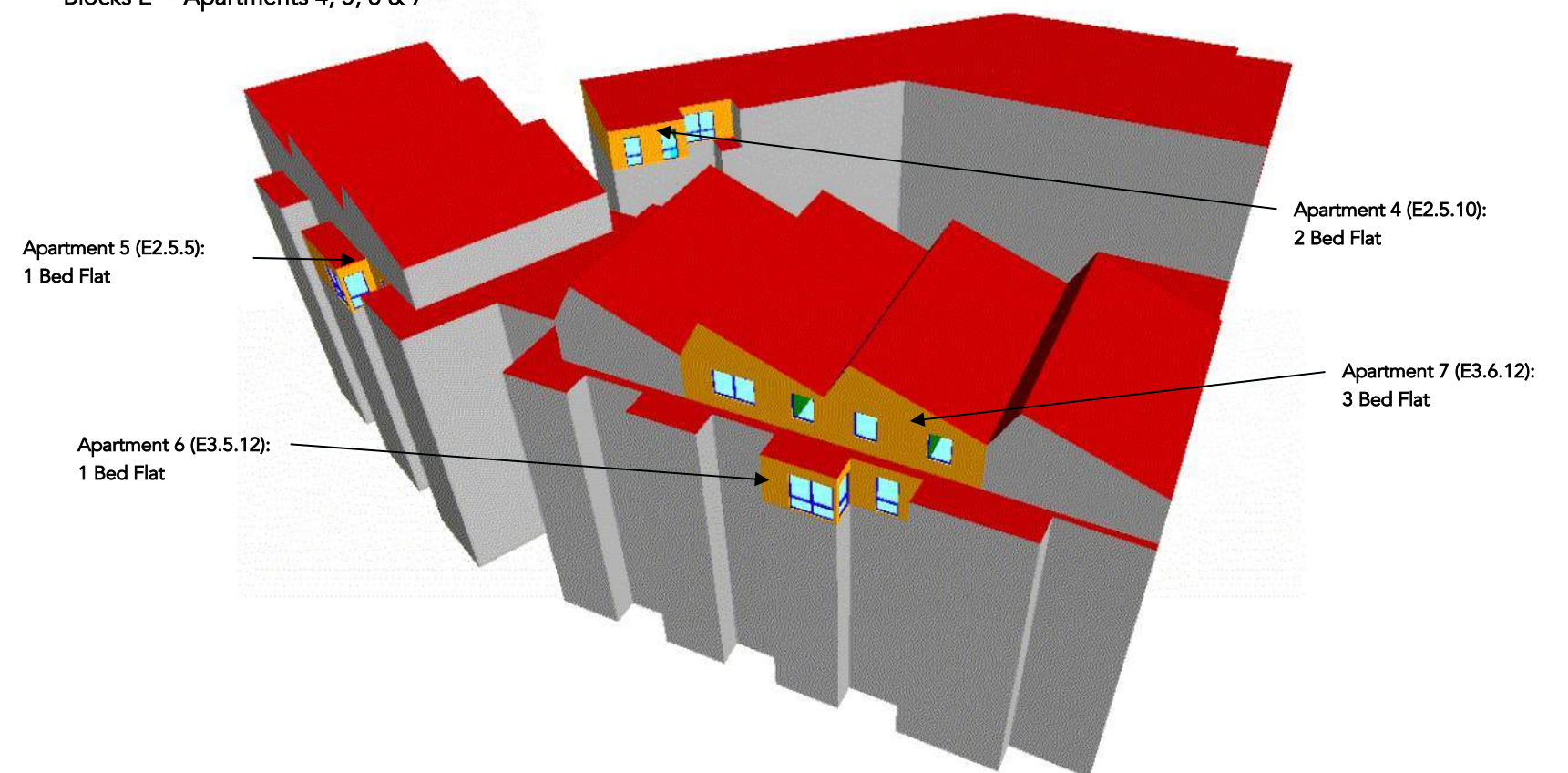
Block B – Apartments 1 & 2



Blocks D – Apartment 3



Blocks E – Apartments 4, 5, 6 & 7



Site overview

The site plan on this page shows the site and indicates the domestic and non-domestic buildings.

The development consists of 5 blocks with 3 domestic blocks and 2 non-domestic blocks.

The apartments which have been assessed using the CIBSE TM59 methodology are in the following blocks:

- Block B
- Block D
- Block E

A sample of 7 apartments have been selected across the three blocks to give a fair representation of the performance of the scheme.



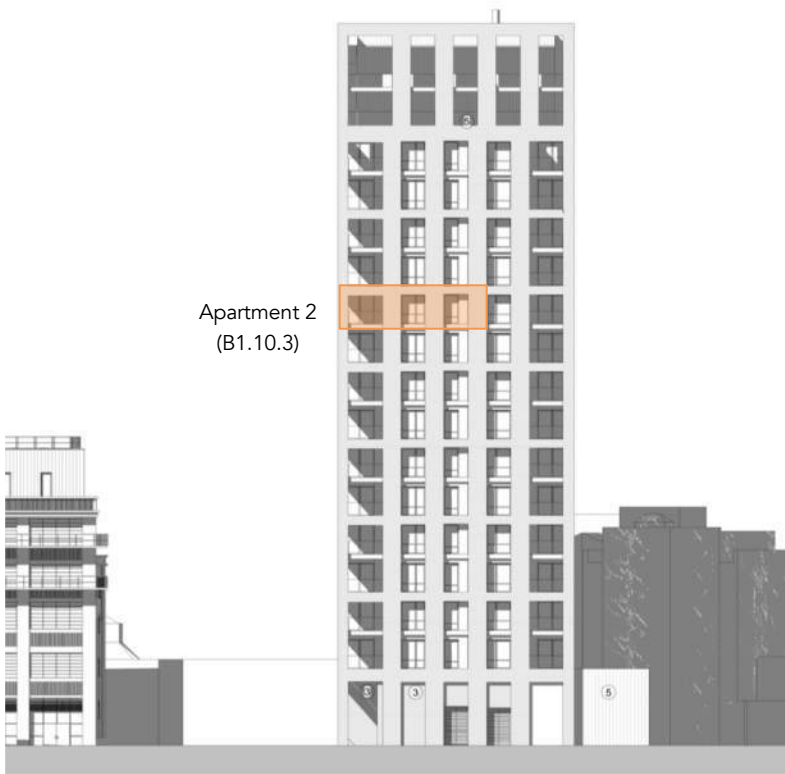
Sample of apartments modelled - Block B

This page shows a set of plans and elevations of the units which have been modelled for Block B.

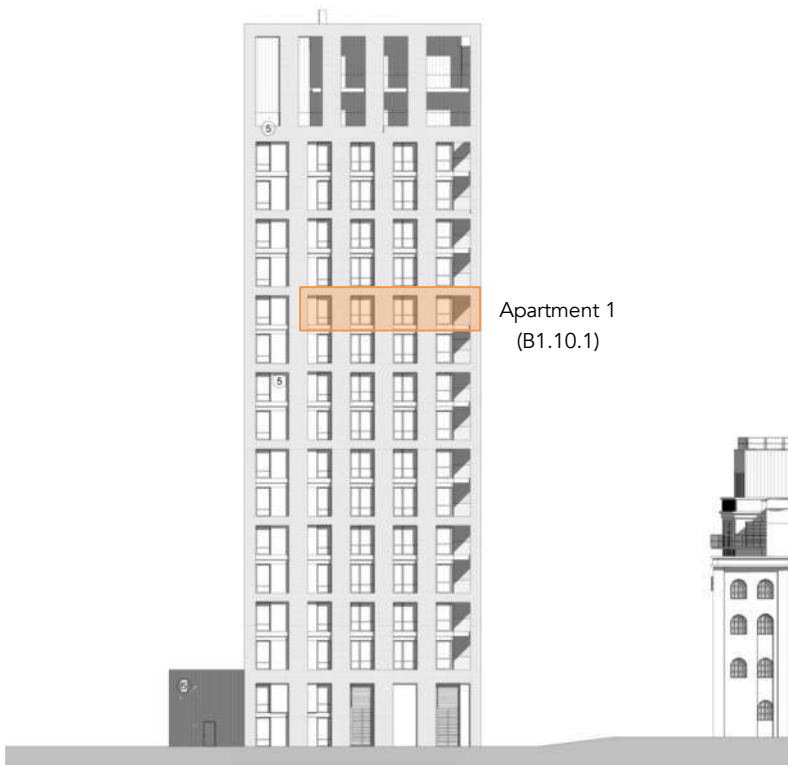
Block B



10th Floor



South Elevation

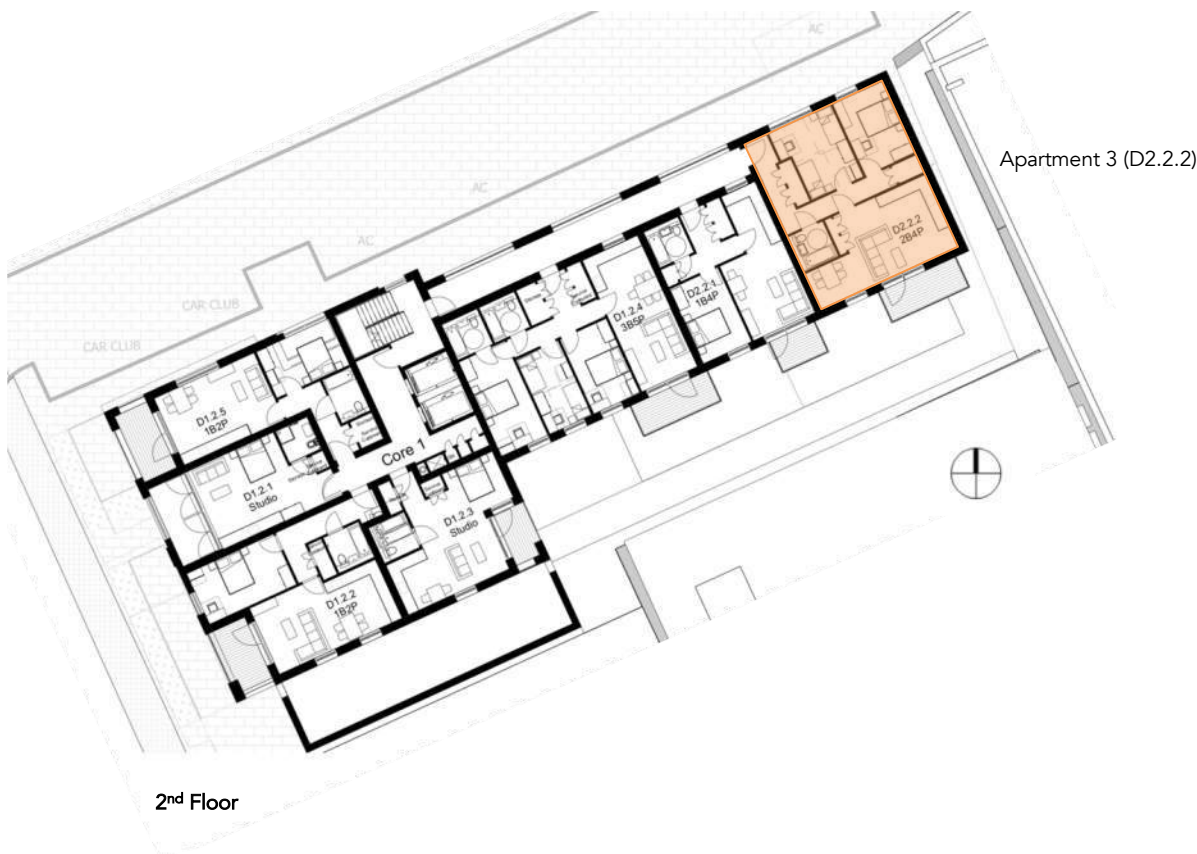


North Elevation

Sample of apartments modelled - Block D

This page shows a set of plans and elevations of the unit which has been modelled for Block D.

Block D



South Elevation



North Elevation

Sample of apartments modelled - Block E

This page shows a set of plans and elevations of the units which have been modelled for Block E.

