V 1.0 Mar 2024

Fit Out // Rip Out

A Study on the Carbon Cost of Cat A

ALLFORD HALL MONAGHAN MORRIS

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Hours of detailing and coordination, large amounts of materials, and months of manufacturing go into creating Cat A fit outs for speculative offices. Fit outs which, too often, come to their untimely end only weeks after practical completion, only to be replaced by a new tenant's bespoke specification.

This pattern of fit out - rip out is then repeated across the life of a building, in line with tenant turnover.

While the wasted resources used to create these temporary Cat A fit outs can be traced, and expenditure summed up, the carbon cost they incur typically goes unquantified. The construction industry continues to deepen its understanding of the carbon emissions associated with the manufacture, assembly, and construction of the built environment, however the carbon impacts of Cat A fit outs are not typically fully accounted for.

This study explores the carbon impacts of the industry standard approach to the design, construction, and marketing of speculative office space and examines the effects of continued tenant turnover on whole life carbon. By utilising AHMM's Delivering

// Rip Out

Net Zero Carbon Toolkit[1] to analyse recent Cat A fit out projects, the Building Performance Team at AHMM has been able to provide much needed data. Through conversations with industry stakeholders, the team sought to understand the drivers behind the current practices.

The aim of sharing the findings in this report is to support the argument for radical change within the speculative office market, and to demonstrate the consequences of the current paradigm.

With the effects of climate change becoming more frequent and devastating, the need for change is more urgent than ever. Conscious of this, the built environment has made commitments, set targets, and created guidance, such as Architects Declare[2], the RIBA 2030 Climate Challenge[3] and the LETI Climate Emergency Design Guide[4].

All of the above state the need for reducing the embodied carbon emissions associated with construction; Cat A fit outs are no exception.

//

The limited data available on Cat A makes it difficult to understand the scale of the problem

The problem

The industry standard practice of Cat A fit out - rip out generates waste over the life time of a building.

The nature of a speculative office means it is designed to appeal to as wide a market as possible. Not only do building owners look to attract potential tenants with high-end office space, but assurances that key performance parameters will be met also need to be made for market satisfaction. Commonly used definitions refer to parameters set by the British Council for Offices (BCO) and include everything from operational comfort temperatures to toilet provision. These requirements can lead to a generic Cat A fit out which, whilst designed to be as flexible as possible, typically cannot meet the specific needs of an eventual tenant-specific Cat B fit out, thus beginning the cycle of fit out - rip out.

Waste is potentially generated at two points in the life cycle of a fit out:

1. Initial leasing of the space

When marketing a building, it is frequently necessary to illustrate to prospective tenants how a space is ready for their Cat B fit out and demonstrate the potential of the space. However, with this marketing fit out being purposely generic to appeal to a wide audience, it is often far from what the eventual tenant wants. As a result, this initial fit out is often ripped out and replaced with an interior bespoke to the client.

2. Subsequent tenant turnover

An office space can be occupied by many tenants over the life of a building. This can result in an accelerated turnover of Cat A, as incoming tenants rip out the existing installation and replace it with their own bespoke specification more suited to accommodate their Cat B. This issue can be further compounded by dilapidation clauses which require outgoing tenants to reinstate the landlord's initial specification which is then inevitably, once again, ripped out by a new tenant.

The British Council for Offices (BCO) Guide to Specification[5] also defines the boundaries of responsibility in a building: which parts will remain the responsibility of the landlord and what will be handed over to incoming tenants. This boundary is a legal one, but it also plays a key role in determining a tenant's scope for personalising a space with Cat B fit out. **Table 1** identifies which side of the tenant/landlord boundary building elements sit, and what is included within the following categories of development:

Shell and Core includes the construction of the building structure and external envelope, as well as core services which are terminated where they enter lettable areas, finishes to communal areas, vertical circulation and toilets. Life safety core infrastructure is also installed e.g. sprinkler tanks. Lettable spaces are provided as simple structural shells.

Shell and Floor includes Shell and Core provision plus providing both raised access floor and temporary lighting to lettable floor areas.

Category A (Cat A) provides additional elements to the lettable space. It includes raised access floors, and basic finishes to floor and core walls. It also extends central services across the lettable floorplates including lighting, ventilation, heating and cooling.

Category A+ (Cat A+) creates a ready-to-go office space provided by the landlord including Cat A, plus cellular spaces, furniture, and services.

Category B (Cat B) is usually fitted out by the tenant and includes: finishes to floors and walls including bespoke branding; IT services; and furniture.

Despite these well-defined requirements, the exact specification of a Cat A fit out can vary, with influences from the target market and location of the building, to aesthetic and service design strategies. This variety of approach to Cat A delivery is the key focus of this study, with analysis of case study projects demonstrating the consequences of different design choices on upfront and whole life carbon. The results highlight the misalignment of carbon responsibility across the building life cycle, with emissions over the life of a building split between landlords and tenants.

// Table 1
Elements within types of fit out defined by the BCO

	Shell and Core	Shell and Floor	Cat A	Cat A+*	Cat B	**Included in case studies**	
Main building structure	●						**LANDLORD DEMISE**
Vertical circulation, toilets, lift lobbies, common cores	●						
Base build plant and equipment (terminated at each floor)	●						
Life safety incl. sprinkler tanks and main alarm panel	●						
Temporary fire alarms and sprinklers (if needed)	●						
Finishes to office faces of core and external walls	●						
Raised access floors inc. sealing of slab below		●	●	●		●	**TENANT DEMISE**
Temporary space lighting		●					
Suspended ceiling			●	●		●	
Skirting			●	●		○	
Cooling and heating systems			●	●		●	
Office ventilation systems			●	●		●	
Uniform lighting			●	●		●	
Fire alarms, sprinklers and emergency lighting			●	●		●	
Distribution boards			●	●		●	
Energy meters			●	●		x	
Office carpet			●	●		○	
Floor boxes			●	●		●	
Anti-glare blinds			●	●		●	
Basic statutory signage			●	●		●	
Basic security system to common areas			●	●		●	
Creation of cellular spaces				●	●		
Upgrade to core finishes				●	●		
Internal partitioning				●	●		
Floor finishes				●	●		
Decoration and branding					●		
Furniture				●	●		
Mechanical, electrical, and lighting upgrade				●	●		
Feature lighting				●	●		
IT and communications equipment				●	●		
Adaptation of life safety systems				●	●		
Security equipment installation				●	●		
Feature connections between floors				●	●		

* Cat A+ defined by the BCO as plug-and-play.
○ Elements not included as not part of case study designs
x Elements not included

Why

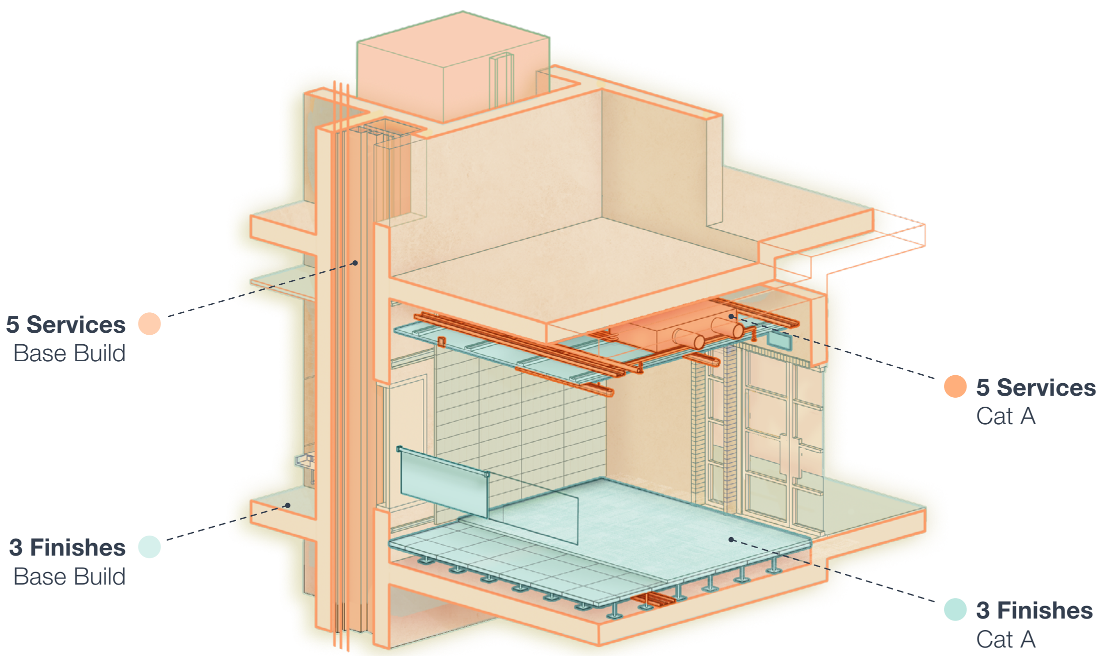
There is currently limited data available to understand the carbon emissions associated with Cat A fit out. Despite Cat A carbon being counted in Whole Life Carbon Assessments (WLCA), the structure of these models means the data is easily lost within wider building carbon figures. This makes it difficult to fully evaluate the benefits of choosing a more 'light touch' approach to fit out.

The Royal Institution of Chartered Surveyors (RICS) sets out the scope for WLCA models[6], assigning all parts of a building into element categories. As demonstrated in **Figure 1**, elements within Cat A fit out span across two of these categories: '3 Finishes' and '5 Services'. The RICS provides guidance on how Cat A can be split into these categories, but does not propose a standardised mechanism for reporting these figures independently of those associated with the base build. It is therefore left to the individual assessor to make this distinction. Not having a formalised structure to report Base Build and Cat A fit out emissions separately makes it difficult to identify where carbon savings can be made, despite their serving very different roles within a building.

How

This study aims to address the lack of definition between the reporting of Cat A and Base Build emissions, by focusing only on elements within the lettable floor area. Four AHMM case studies have been selected for analysis, as representative examples of the central London office market, each with differing approaches to delivering high end, verifiable Cat A fit out. The study explores how these differences in approach impact upfront carbon, and considers the lasting influence of fit out design on whole life carbon when viewed alongside potential tenant turnover. The case studies, categorised as Substantial, Significant, Slender, and Subtle, range from a more traditional fit out design with servicing hidden above a suspended ceiling, to designs with fully exposed soffits and servicing. Each design approach is summarised in **Figure 2** and further illustrated in **Figures 3-6.**

Material data was taken from late stage architectural and mechanical, electrical and plumbing (MEP) building information modelling (BIM) models for a typical floor of each case study project. Care was taken to measure and include fixings and connections which may not usually be picked up in more extensive whole life carbon models. This was done using guidance set out in The Chartered Institution of Building Service Engineers (CIBSE) TM 65[7], which provides a methodology for calculating the embodied carbon in building services. This data was then processed for export into OneClick LCA, the industry standard carbon accounting platform.



// Figure 1
Elements in the Base Build and Cat A fit out share the same RICS categories

Data from Environmental Product Declarations (EPDs) was associated with the material quantity take offs to establish upfront carbon emissions associated with each case study design. These are reported as the RICS stage A1-A3 carbon emissions, which are the emissions associated with the extraction and transport of materials, and manufacturing of the components for a building.

A key aspect of investigating the carbon impact of the different approaches to Cat A fit out is understanding the elements that are at risk of being ripped out by an incoming tenant to accommodate their own bespoke interior. For the purposes of this study, these elements were categorised as ‘At Risk’. All other elements were categorised as ‘Baked In’, as they would typically be retained and integrated into an incoming tenant fit out.

‘At Risk’ elements are critical in demonstrating the potential impact of the repeated fit out - rip out cycle on whole life carbon. A potential tenant turnover scenario is mapped across a hypothetical 60-year lifespan for each case study building. A worst case carbon scenario is assumed at each tenant turnover, in which ‘At Risk’ elements are ripped out and replaced in their entirety, even where part-replacement of an element could be possible. These patterns are then compared to the RICS standard methodology, which sets out typical replacement rates for elements across the life of a building.

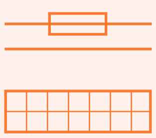
Limitations

This study uses a small sample size, using four case studies to represent four models of Cat A fit out. The designs shown are not an exhaustive representation, with many more variations of Cat A possible. Therefore this study aims to set out an approach that can be used by the wider industry to quantify the carbon impact of various type of Cat A, leading to more transparency in the speculative office market.

This study only examines elements within the tenant demise that the landlord retains responsibility for. It does not include operational carbon, as operational efficiency is influenced by the whole building strategy, so not specifically reflective of the Cat A design. However, it is important to recognise the wider context of the building within which these fit outs exist. Systems such as building servicing strategies can impact the strategy, subsequent carbon emissions, and operational efficiency of a Cat A fit out.

The cost variation between the four case studies has not been included in this study. Cost heavily influences decision making in the design and delivery of projects, and a well established approach exists for costing Cat A fit outs and subsequent Cat B tenant expenditure. This study focuses on the less developed area of understanding, but can provide the basis for further exploration into how cost and carbon impact for Cat A fit out is related.

// Figure 2
Cat A classification of the four AHMM case studies

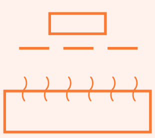


Substantial

Supply air is delivered through high level ductwork to localised fan coil units providing heating and cooling.

Services and sprinkler system are concealed by a uniform suspended ceiling. Lighting and ventilation panels are integrated into ceiling.

Anti-glare blinds are installed.

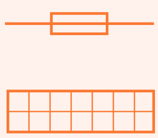


Significant

A displacement ventilation strategy is used, supplying air through the raised access floor.

Recirculating fan coil units on the soffit provide heating and cooling.

Fan coil units are concealed above bespoke acoustic rafts with integrated lighting. Anti-glare blinds are installed.

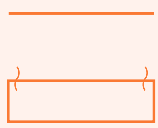


Slender

Supply air is delivered through high level ductwork to localised fan coil units providing heating and cooling.

Services and sprinkler system are exposed, as well as cable trays for the soffit hung lighting.

Anti-glare blinds are installed.



Subtle

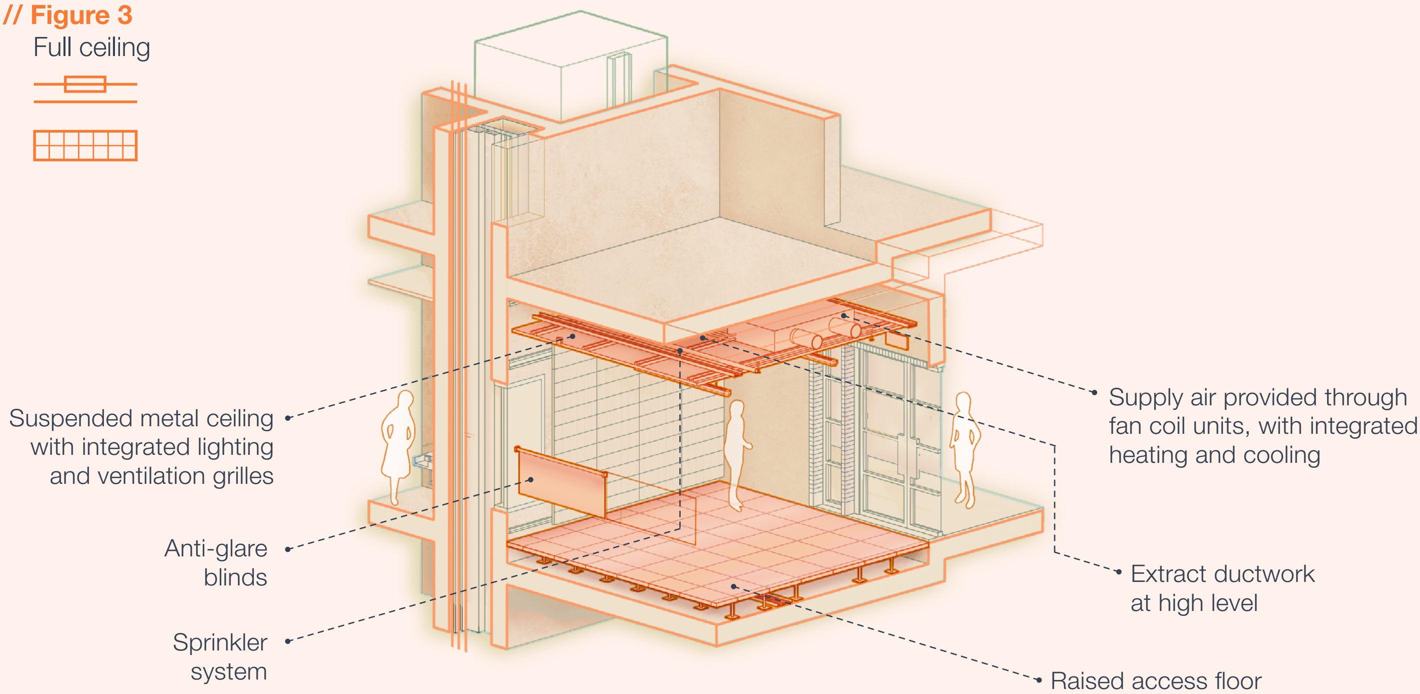
High level air supply is combined with openable windows to provide a mixed-mode ventilation strategy. Heating and cooling is provided via the thermally activated concrete soffit and fan coil units can be installed where larger cooling loads are required. Trench heaters integrated into the raised access floor line the perimeter. Anti-glare blinds are installed.

Cat A case studies

Elements within each Cat A fit out design

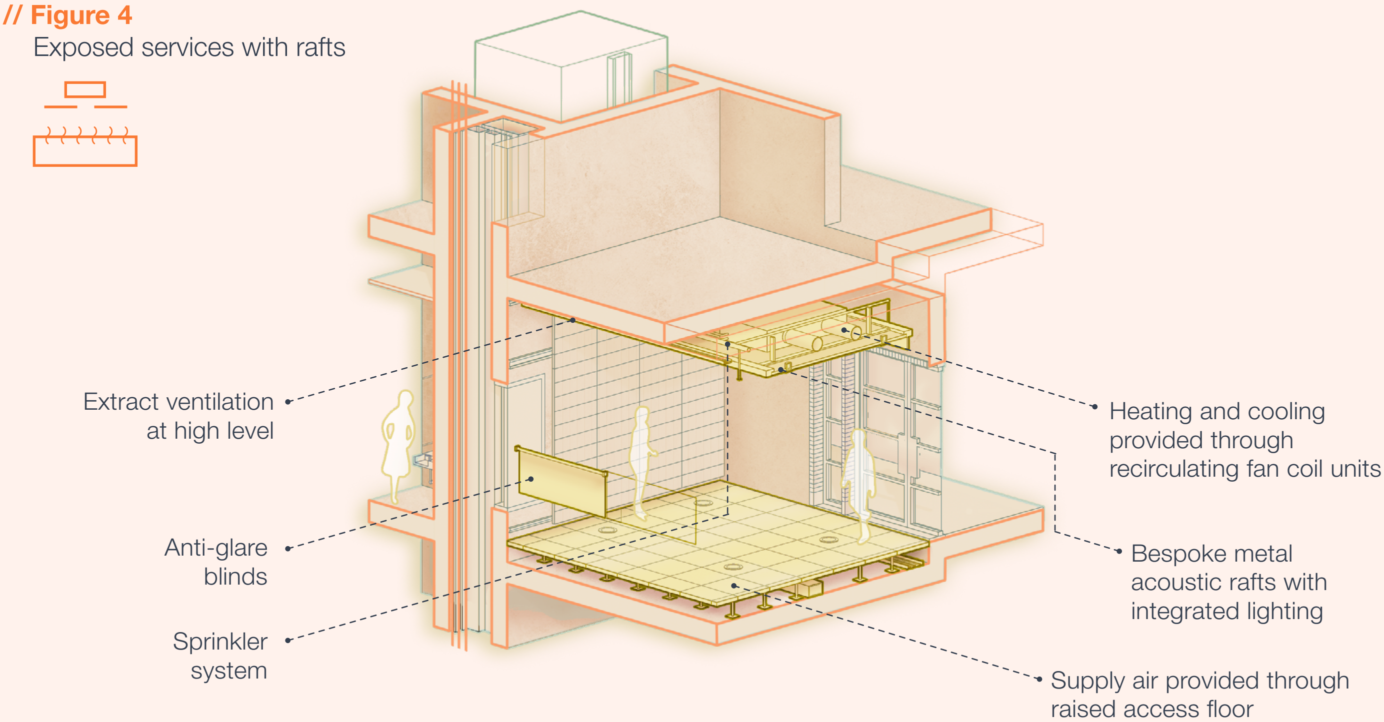
Substantial

// Figure 3
Full ceiling



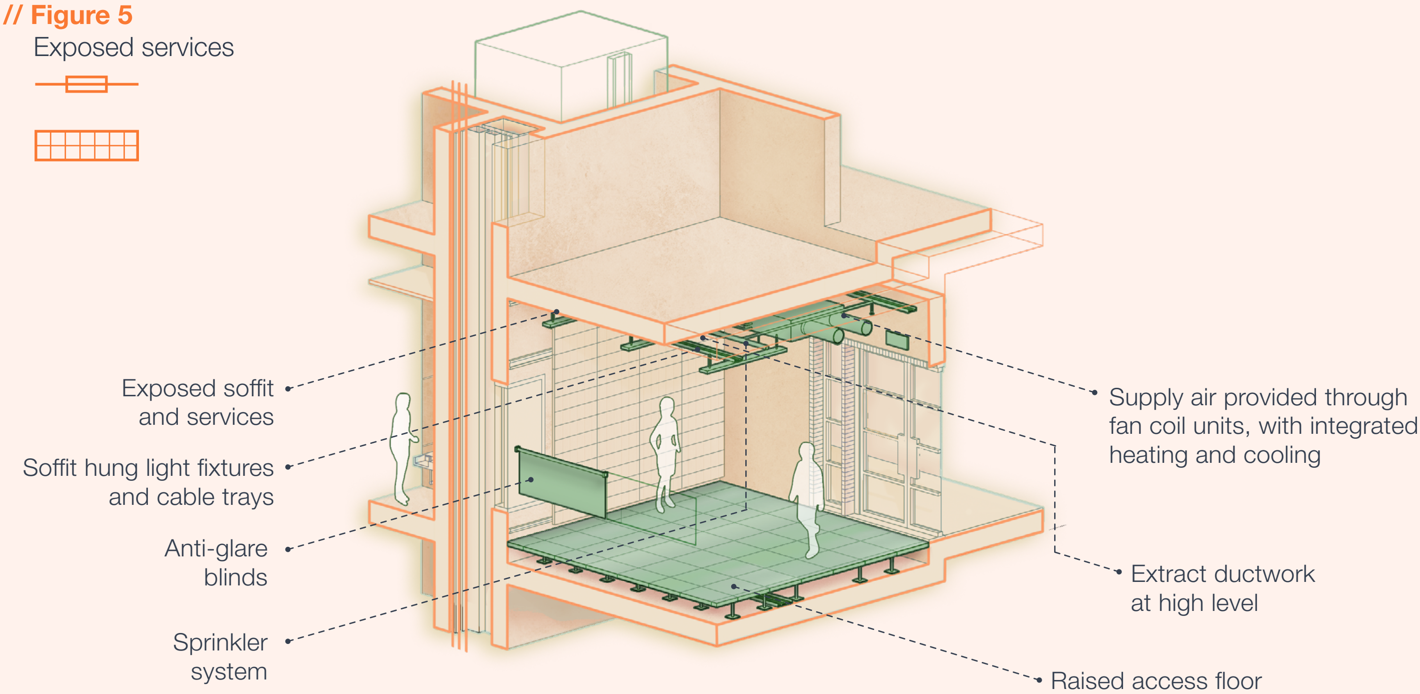
Significant

// Figure 4
Exposed services with rafts



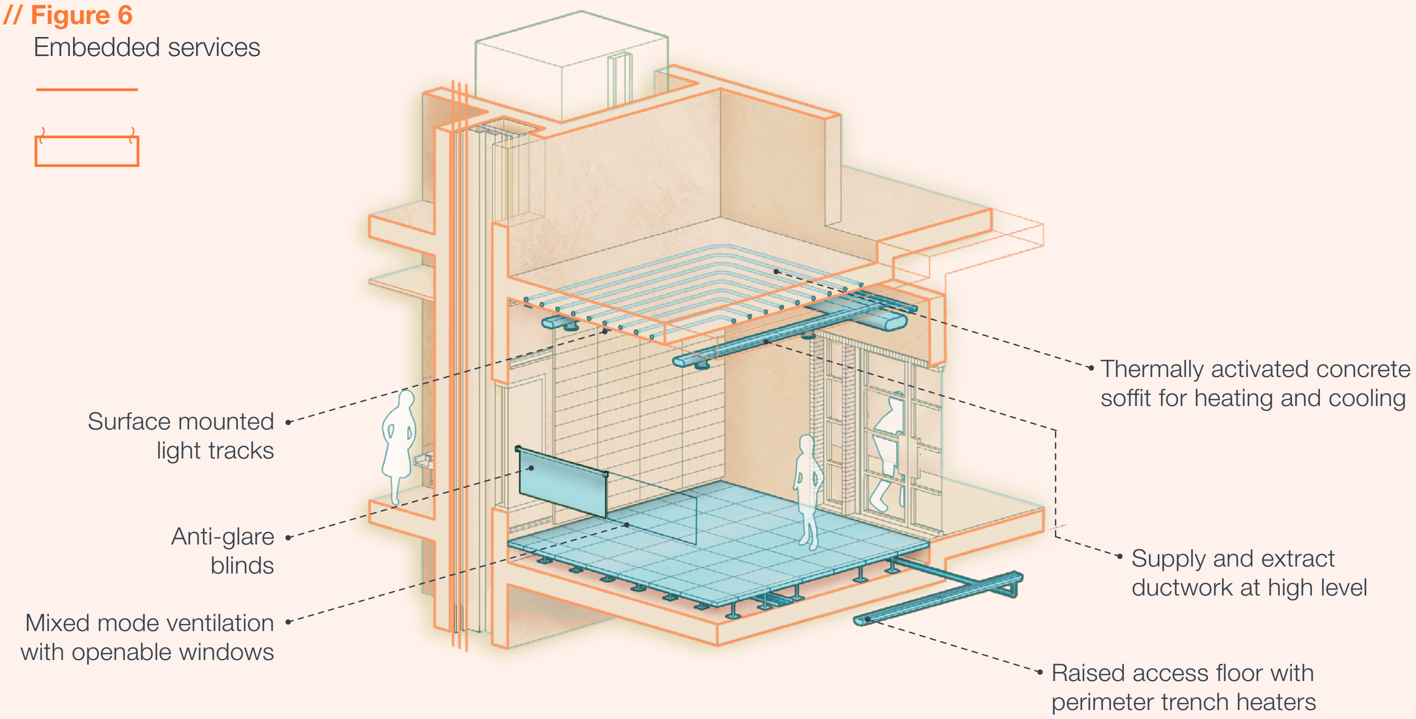
Slender

// Figure 5
Exposed services



Subtle

// Figure 6
Embedded services



What’s up-front with Cat A?

The carbon cost of Cat A

Aesthetic and servicing choices have a big impact on the carbon emissions associated with constructing Cat A fit out.

The RICS stage A1-A3 carbon emissions have been calculated for the four Cat A fit outs within AHMM-designed commercial buildings, to understand the influence of design on upfront carbon. **Figure 7** shows how the upfront carbon emissions across the four projects vary greatly, from 58kgCO_2/m^2 for the Subtle fit out, to 92kgCO_2/m^2 for the Significant fit out.

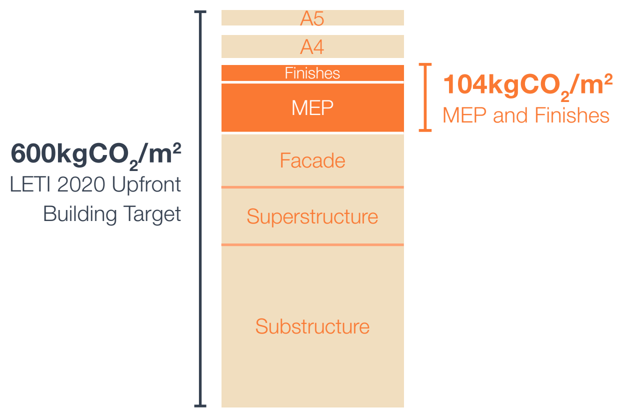
For each case study, the upfront carbon has been categorised by elements as defined by the BCO definition of Cat A features. These are outlined in the key of **Figure 8**. A clear trend across all designs is the notable impact of raised access floor (RAF), contributing 29kgCO_2/m^2 to the Substantial, Slender, and Subtle designs. The graph shows that the carbon impact of RAF in the Significant Cat A model is slightly higher than the other three models, contributing 42kgCO_2/m^2. The Significant model has a deeper floor void to accommodate the underfloor displacement ventilation system which, in turn, reduces the amount of ventilation ductwork required. In the other three models, high levels of ductwork are required to provide on-floor ventilation.

Heating and cooling equipment contributes a considerable amount of carbon in the Substantial, Significant, and Slender Cat A models. These three models all rely on fan coil units (FCUs) to provide heating and cooling. Despite ventilation being provided through the floor in the Significant model, there is still ductwork associated with the FCUs. The ducts for these are insulated and wrapped in additional aluminium, so despite fewer linear metres of ductwork, they still contribute 10kgCO_2/m^2.

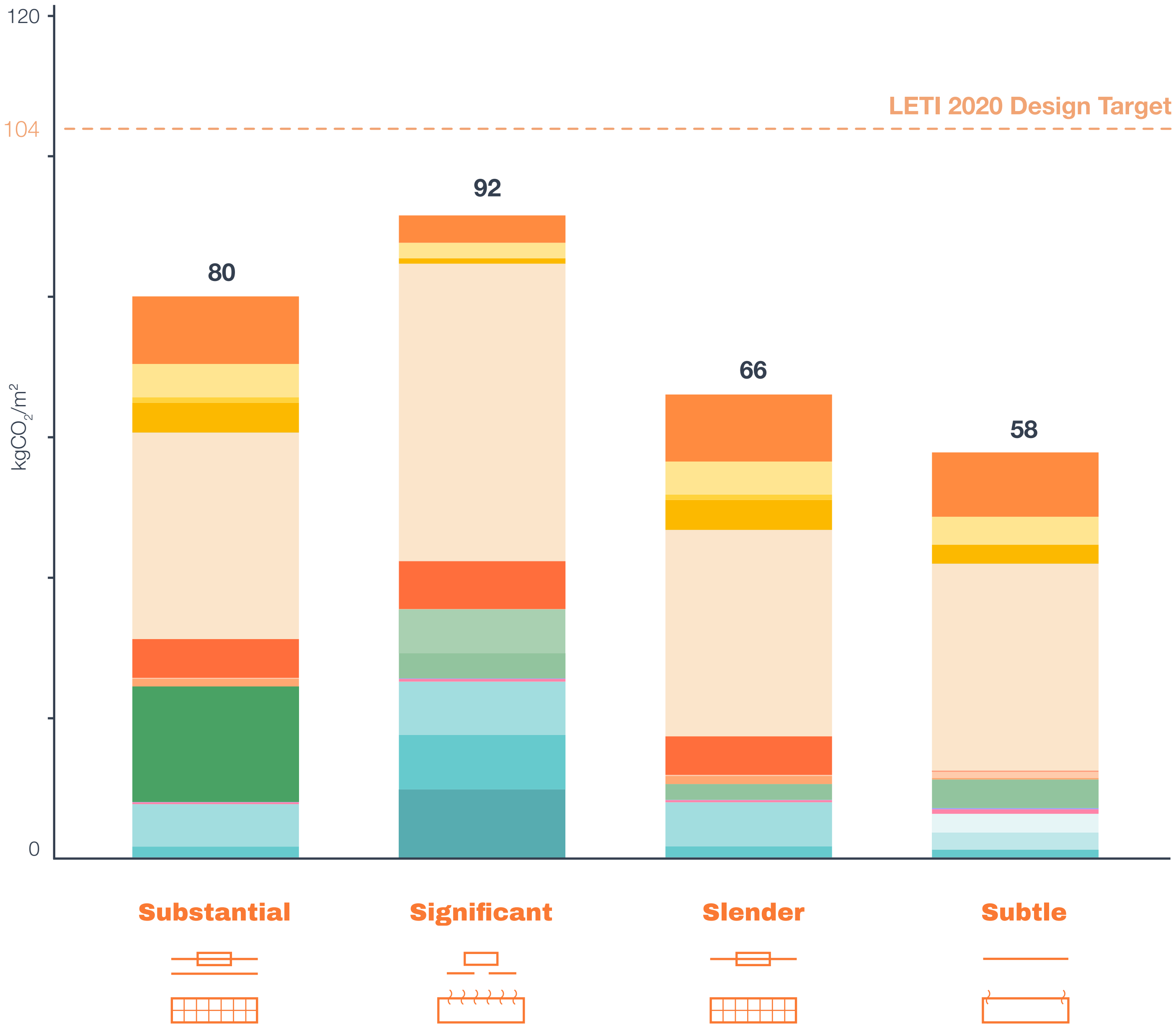
The Subtle Cat A model has the lowest emissions associated with heating and cooling equipment. This model uses pipework set into the concrete soffit to provide heating and cooling through activated thermal mass, trench heaters within the floor provide additional heating around the facade combined with openable windows to form part of the cooling strategy. These measures mean the Subtle model does not rely on fan coil units, but instead supports a plug-in option for FCUs if required for particular environments, for example meeting rooms that have higher heat gains. Aesthetic choices also influence the amount of carbon emissions for each model. The Slender and Subtle Cat A fit outs have exposed soffits and services, and have emissions of around 2 - 4kgCO_2/m^2 for ceiling elements, compared to the Substantial model which has a suspended ceiling required to create a uniform and uninterrupted surface, contributing 16kgCO_2/m^2. While the Significant option has exposed soffits, it also has bespoke ceiling rafts that integrate fan coil units, lighting, and acoustic absorption, resulting in a carbon contribution of 6kgCO_2/m^2.

Even in its most pared back form, the contribution of Cat A fit out to a building's upfront carbon is considerable. The Low Energy Transformation Initiative (LETI) has set targets for the upfront carbon of new build projects. The 2020 target of 600kgCO_2/m^2 is broken down by building category: substructure, superstructure, facade, MEP, and finishes, along with the carbon associated with transport and construction of the building, shown in **Figure 7.** Elements within a Cat A fit out span across the MEP and Finishes categories, which are estimated by LETI to contribute 104kgCO_2/m^2 to the building total. As well as elements within the lettable floor area, this figure includes MEP and finishes for the landlord spaces. As is evident in **Figure 8,** Cat A is responsible for a large portion of these emissions.

// Figure 7
Breakdown of the LETI 2020 Upfront Carbon target



// Figure 8
Upfront carbon emissions associated with each Cat A fit out case study



Key

Uniform Lighting
- Light Fitting
- Control Panel
- Cable and Cable Tray

Ceilings
- Acoustic Raft
- Concrete Sealant
- Suspended Ceiling

Heating and Cooling
- TABs Pipework
- Cable and Cable Tray
- Trench Heater
- Fan Coil Unit
- Pipework
- Ductwork

Fire Alarms, Sprinklers and Emergency Lighting
- Smoke Detectors
- Alarm System
- Sprinkler System

Electrical Supply
- Control Panel
- Cable and Cable Tray

- Ventilation Ductwork
- Anti-Glare Blinds
- Basic Security
- Raised Access Floor
- Emergency Exit Signage

Net to Gross through the eyes of Cat A

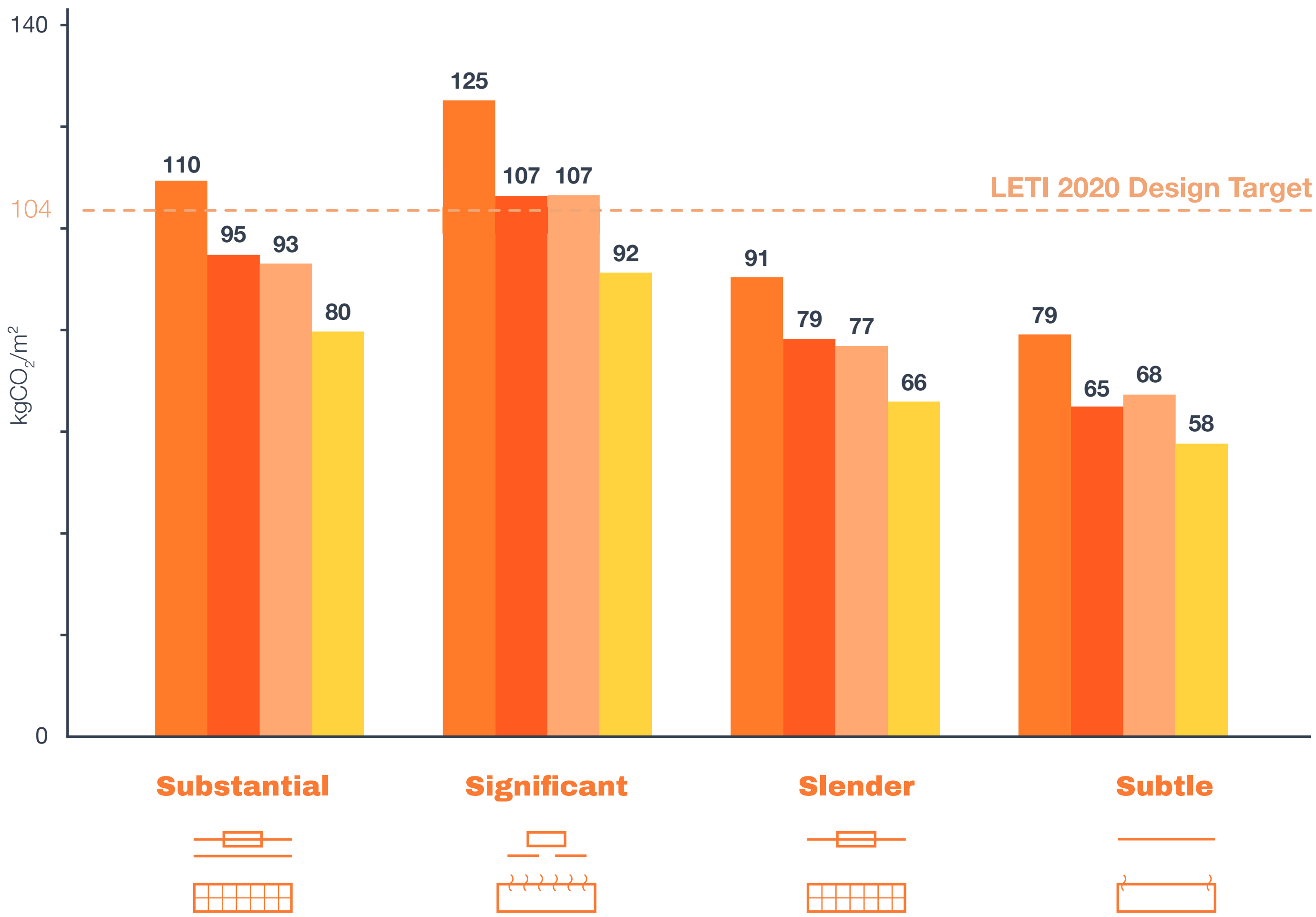
The Net to Gross ratio of an office space is important to acknowledge, as the carbon emission calculations can change depending on the scope of internal space being measured.

The four case study projects are real buildings of differing size and complexity, with Net to Gross ratios ranging from 82% to 87% for typical office floors. This variation in floor plate efficiency can skew the reported carbon data. The commercial real estate industry typically reports carbon data of a Cat A fit out in relation to the Gross Internal Area (GIA) of the whole building within which it sits. An average Net to Gross ratio of 73% for a speculative commercial office was established using AHMM's database of completed projects.

This Net to Gross ratio has been used to calculate the carbon totals in this study. To test the impact of this variation between buildings, the carbon cost per square metre of the four case studies were calculated against different area metrics as illustrated in **Figure 9**:

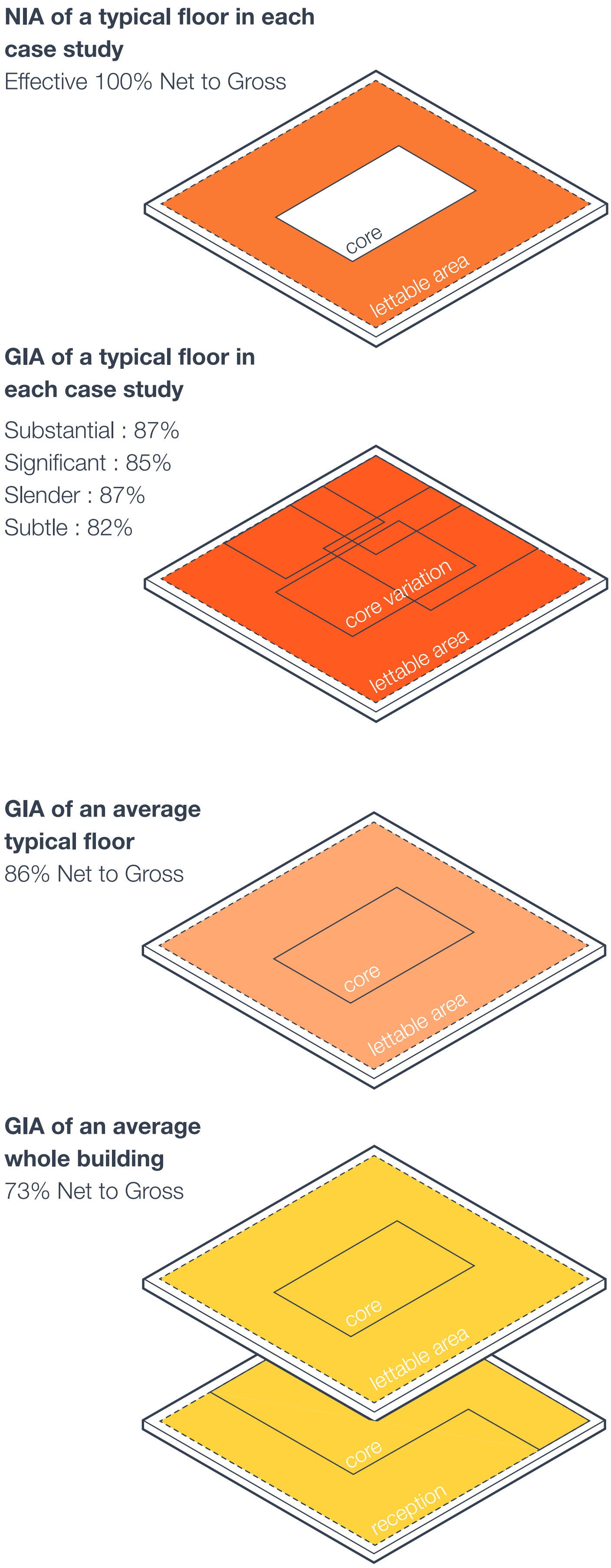
- **Net Internal Area (NIA) of a typical floor** in each case study
- **GIA of a typical floor** in each case study
- **GIA of an average typical floor of 86% Net to Gross** based on four case studies
- **GIA of an average whole building of 73% Net to Gross** based on four case studies

// Figure 9
Effect of Net to Gross Ratio on reported Cat A figures



The coloured regions illustrated in **Figure 10** denote the area used to calculate the carbon totals for each option. The **NIA of a typical floor** measures the lettable floor area in which Cat A is installed, reporting the actual per square meter rate of each Cat A design. For the sake of comparison this has an effective Net to Gross ratio of 100%. If carbon figures are rationalised over the **GIA of a typical floor**, the size of the core in relation to lettable area then comes into play. The case study projects have Net to Gross ratios ranging from 82-87%. To provide a fair comparison of the carbon numbers, an **average Net to Gross of 86% for a typical floor** has been calculated from the four options. The most typical figure used for reporting carbon figures is the **GIA of a whole building**. This has a lower Net to Gross than a typical floor due to the ground floor being given over to none lettable floor area, such as reception space. **Figure 9** shows that as the Net to Gross ratio gets smaller so do the carbon figures.

It is interesting to note that the carbon cost per square meter is higher than the LETI 2030 targets for the Substantial case study when using the NIA ratio, and for the Significant case study when using NIA and both GIA ratios. To ensure the data generated from this study was most comparable to the industry standard way of reporting, as well as LETI and RIBA 2030 targets, the Net to Gross ratio figure of 73% was used. However, examining this more closely, it is clear that the true carbon cost of fit out is disguised by the reporting methods used by the profession.



// Figure 10
Net to Gross ratios change depending on how much of the building is referenced in the calculation. Coloured regions denote the areas used for carbon calculations.

‘Baked In’ vs ‘At Risk’

Considering the likelihood of elements within Cat A fit out that may be ripped out by incoming tenants can have a big impact on life cycle carbon.

One of the fundamental issues of Cat A fit out is its impermanence within a building. Over many years and tenant changes, with multiple stakeholders and project teams recrafting the space, the thread of responsibility for the carbon impact of Cat A is difficult to trace.

However, it is possible to make design decisions for the base build that will positively impact the carbon outcomes of an office fit out, making space easier and less costly to adapt throughout the life of a building. By embedding functions which would typically be within a Cat A specification into the base build, there would be fewer elements at risk of being ripped out and replaced with tenant changes.

To investigate this further, this study has categorised the elements of all four case studies as either ‘At Risk’ or ‘Baked In’. ‘At Risk’ elements are those which would typically be ripped out through the tenant turnover process, and ‘Baked In’ elements are those that can be retained and reused by each incoming tenant.

Figure 11 shows the same carbon data as **Figure 8**, separating the ‘At Risk’ and ‘Baked In’ elements, showing them above and below the X axis respectively.

Raised access floors have been categorised as ‘Baked In’ for all case studies, as a floor can accommodate most fit out designs and, as such, does not require replacing between tenants. Services such as ventilation ductwork and trench heaters are also considered ‘Baked In’ as they are integrated within the floor system.

For the Substantial, Significant, and Slender models an on floor sprinkler system forms part of the fire strategy. This is considered to be ‘Baked In’ as it forms part of the essential life safety systems. These are generally adapted to suit a tenant’s bespoke fit out, rather than being replaced in their entirety.

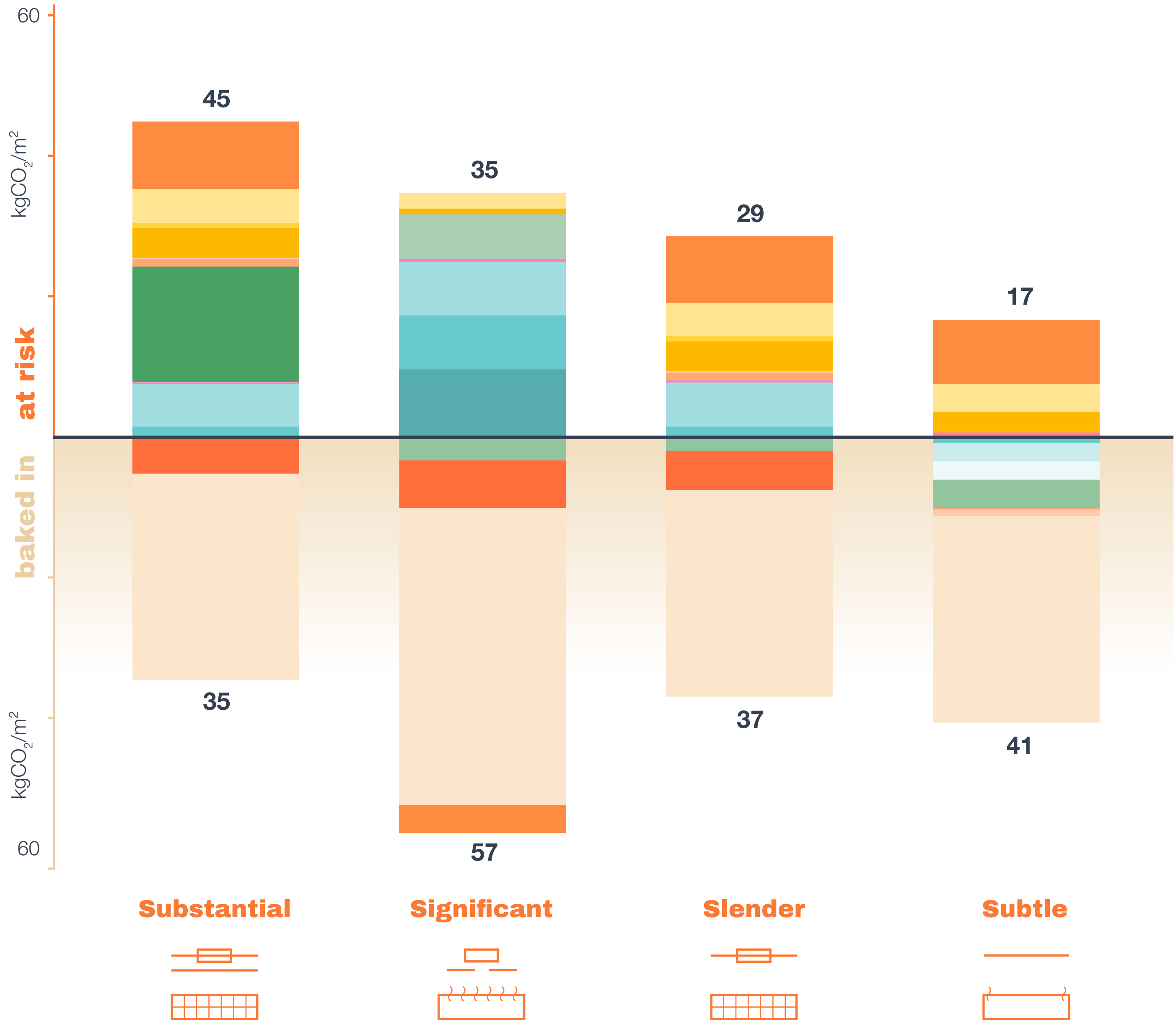
Items such as lighting, soffit mounted MEP equipment, and ceiling finishes (bespoke rafts or uniform suspended ceilings) are categorised as ‘At Risk’, as they are more likely to interfere with a tenant’s Cat B fit out or programmatic requirements.

The repeated replacement of ‘At Risk’ elements over a building’s lifetime will have a drastic impact on a building’s whole life carbon, so it is critical to understand how to mitigate this.

Figure 11 shows a clear difference in the proportion of ‘At Risk’ to ‘Baked In’ elements across the four case studies. The Substantial model has the highest carbon value of ‘At Risk’ elements, with over 50% of embodied carbon of the Cat A fit out potentially wasted due to elements being ripped out with future tenant changes. The Subtle model has the lowest carbon value of ‘At Risk’ elements, with over two thirds of its embodied carbon emissions being ‘Baked In’. Two key reasons for this model’s good results are that all parts of the heating and cooling strategy are considered ‘Baked In’ and the pipework for the thermally activated slab is literally baked in to the concrete structure.

Categorising the elements of a Cat A fit out in this way provides a framework to better understand where carbon savings can be made in relation to the tenant turnover cycle across a building’s whole life.

// Figure 11
Upfront carbon split with elements above the axis 'At Risk' of being ripped out by a tenant and elements below the axis considered 'Baked In'



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How many lives does Cat A have?

Lasting influence

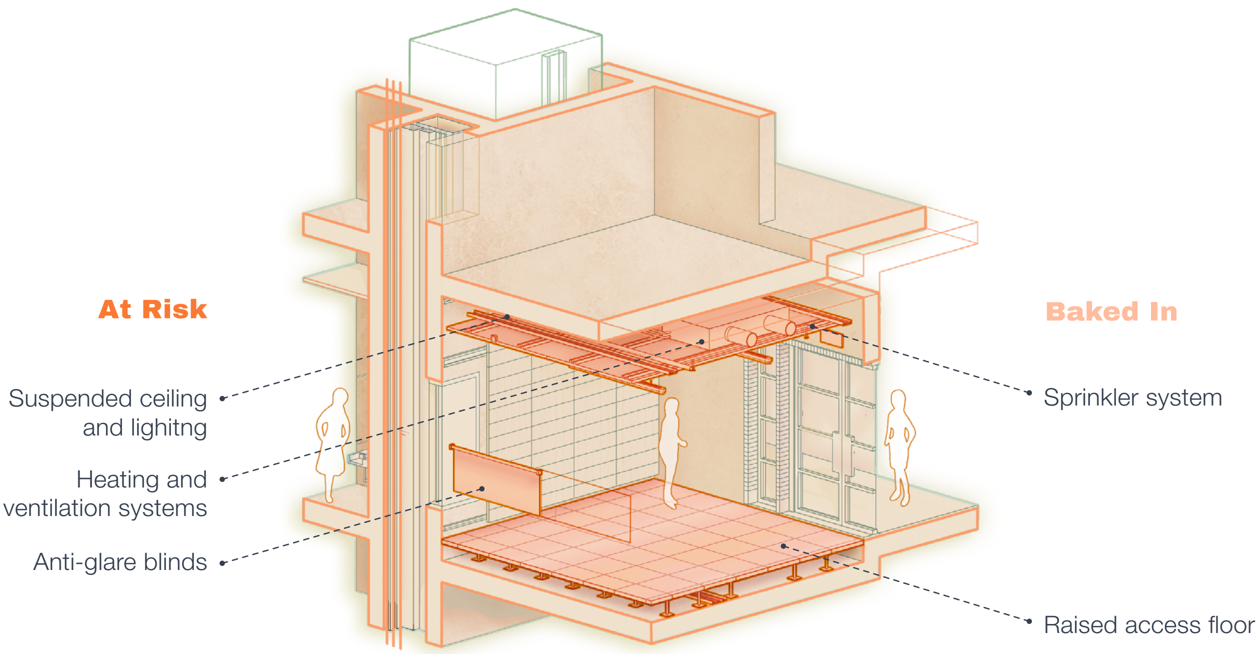
An office space will have many tenants over the life of a building, each adapting the space to their own needs.

The RICS WLCA framework assumes that elements specified and installed during the construction of a building will be left in-situ until the end of their service life. Despite the WLCA framework stating an expected lifespan, or Reference Study Period (RSP), of 10 years for isolated fit out projects, when considering the life cycle carbon impacts of a building at the start of its life, consideration for this fit out cycle is not included. Instead, elements within the initial fit out design are assumed to remain in line with their service life, ranging between 15 and 40 years depending on the item **(Table 2)**. In practice, however, speculative Cat A fit out is often ripped out within months of a building's practical completion and the fit out - rip out cycle can happen at a much faster rate in line with outgoing and incoming tenants.

According to commercial property agent DeVono[8], the typical lease length of a small office (up to 10,000 square feet) in the City of London is 5.1 years, with BNP Paribas Real Estate stating that approximately one third of lease agreements are renewed[9]. Using these timescales as a guide, this report assumes that an office space in central

Substantial

// Figure 12
Elements within the Substantial Cat A fit out categorised as 'Baked In' vs 'At Risk'



London would have approximately eight different tenants over a 60 year period, and therefore eight cycles of Cat A fit out potentially being ripped out and replaced.

To understand the implications of Cat A on whole life carbon, the carbon data from the two case studies were mapped against the DeVono lease pattern information, using *AHMM's Delivering Net Zero Toolkit*.

In **Figure 13**, the carbon emissions related to the initial, speculative Substantial Cat A fit out are shown by the first bar prior to Practical Completion (PC) with 'At Risk' and 'Baked In' elements illustrated in orange and beige respectively. The study assumes that 'At Risk' elements within the Cat A fit out will be ripped out and replaced with each new tenancy, and that 'Baked In' elements, having remained in-situ for the length of their service life, are replaced after 30 years.

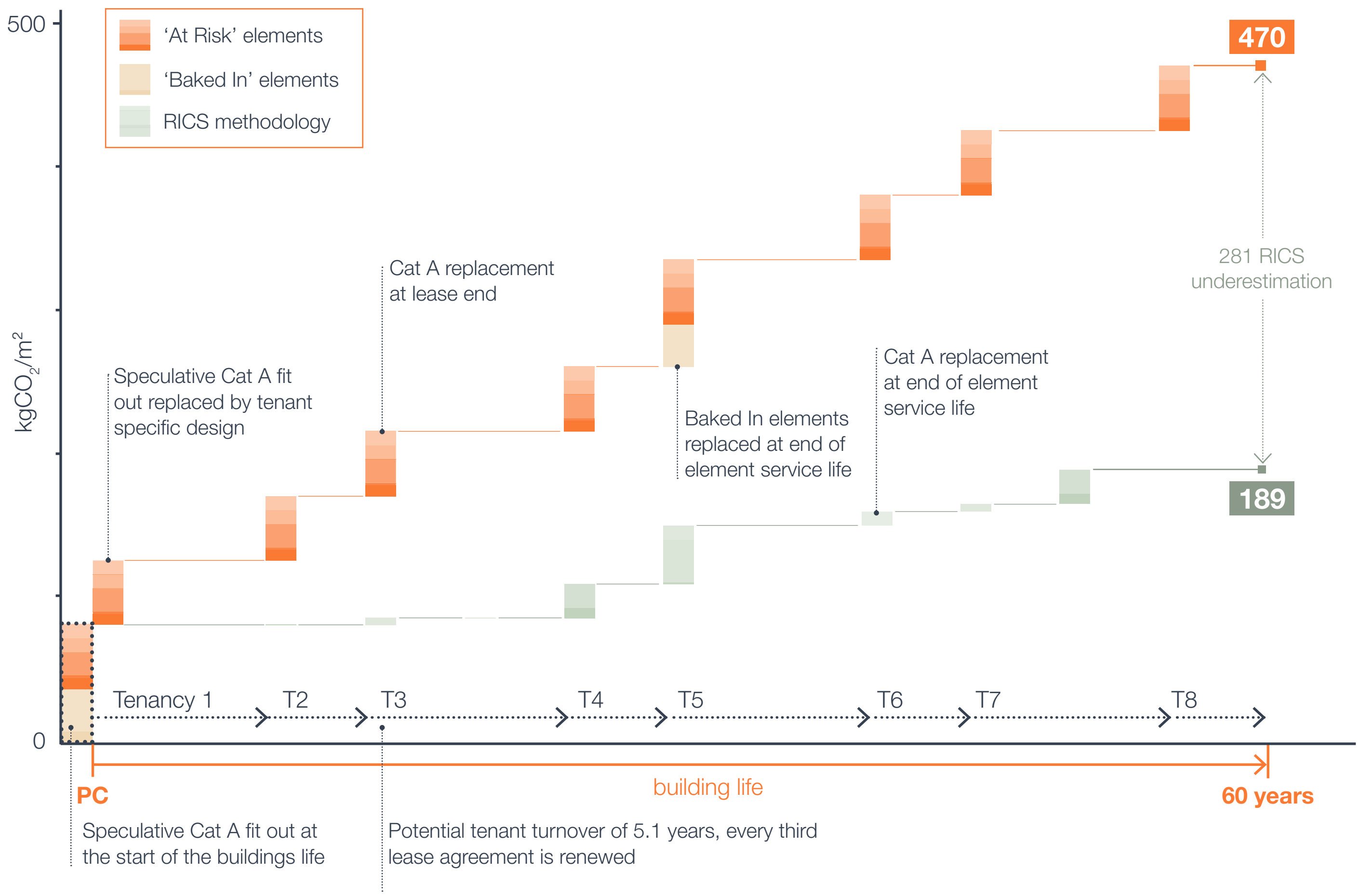
On this basis, the *Delivering Net Zero Toolkit* calculates that the carbon emissions from the fit out - rip out cycle of a Substantial level fit out could reach 470kgCO_2/m^2 over the life of the building. In this scenario, Cat A contributes to over half of the life cycle carbon target of 750kgCO_2/m^2 stated by the RIBA 2030 Challenge.

Figure 13 also includes the carbon emissions predicted when using the RICS methodology (shown in green), which calculates the total carbon emissions as 189kgCO_2/m^2. The 281kgCO_2/m^2 disparity between the two methods of calculating carbon emissions suggests that the current industry standard approach might not be providing an accurate picture.

// Table 2
RICS replacement rates

Raised access floor	**30 years**
Suspended grid ceiling	**25 years**
Space heating and air treatment	**20 years**
Central cooling systems	**15 years**
Galvanised ductwork	**40 years**
Electrical installations	**30 years**
Light fittings	**15 years**

// Figure 13
Comparison of RICS replacement rates to potential tenant fit out - rip out pattern for Substantial fit out, with lease size up to 10,000 square feet



Designing minimal Cat A solutions into the base build can have an influence on whole life carbon.

When calculating whole life carbon emissions of the Subtle fit out case study, using *AHMM's Delivering Net Zero Toolkit* with the same assumed lease pattern and rip out scenario, not only is the upfront carbon emissions figure lower, but the whole life carbon emissions are reduced by 250kgCO_2/m^2.

Figure 15 illustrates how the proportion of 'Baked In' to 'At Risk' elements can affect the cumulative impact of tenant turnover and the associated Cat A fit out - rip out cycle, and how the design of the base build can influence the carbon performance throughout a building's life.

Once a building has reached practical completion and has been contractually handed over, the original design and construction team are rarely involved with landlord and occupier led alterations and design decisions over the years. Introducing the classification of 'Baked In' versus 'At Risk' provides an additional layer of information that can help inform teams from the outset, so that decisions can be made for the base build that minimise the carbon impact of the fit out - rip out cycle throughout the building's life.

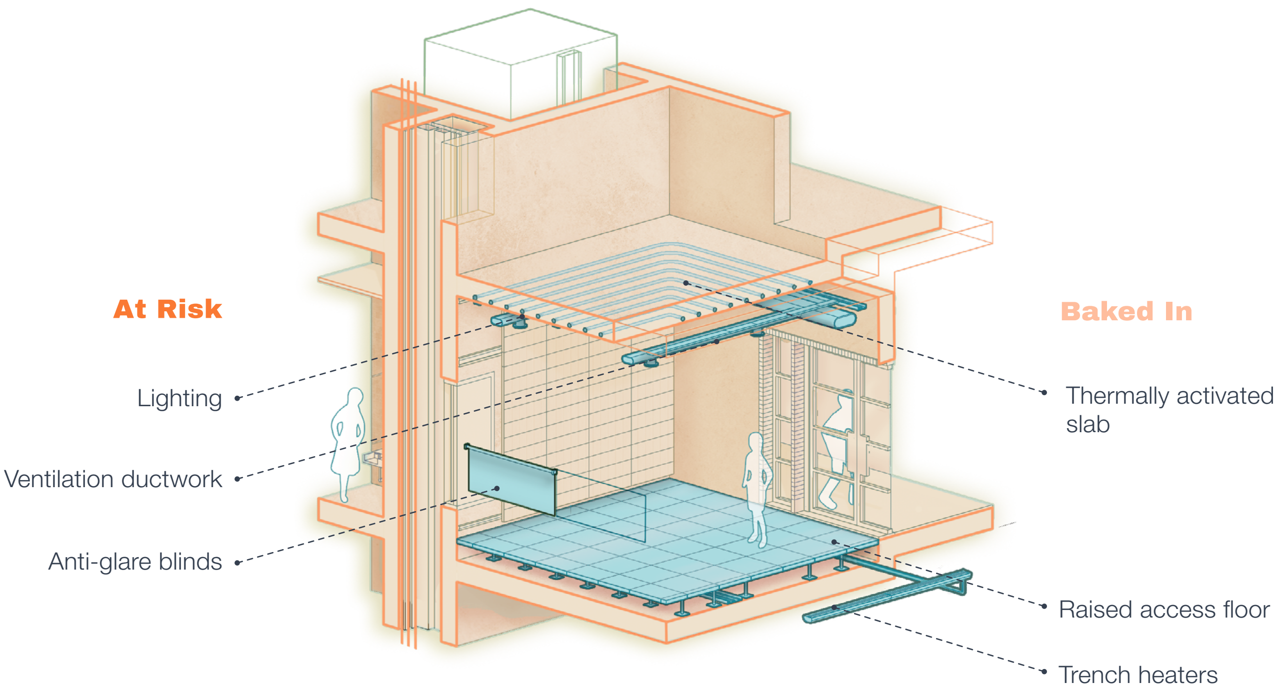
For example, if a building is designed to be reliant on fan coil units that are provided within the Cat A specification, tenants will be required to install them within their own fit out and may be more likely to rip out and replace those provided in the speculative fit out.

An alternative approach demonstrated by the Subtle model, is to utilise the thermal mass of the building and

Subtle

Substantial

// Figure 14
Elements within the Subtle Cat A fit out categorised as 'Baked In' vs 'At Risk'



design concrete core cooling into the base build. This might encourage incoming tenants to leave the thermal mass exposed and be less reliant on mechanical systems, thereby discouraging the unnecessary addition of materials on the ceiling.

It is important for all stakeholders to appreciate how decisions made for base build architecture can encourage leaner and lighter tenant fit outs across the lifespan of buildings.

// Figure 15

Comparison of RICS replacement rates to potential tenant fit out - rip out pattern for Subtle fit out, with lease size up to 10,000 square feet

//

It is important for all stakeholders to appreciate how decisions made for base build architecture can encourage leaner and lighter tenant fit outs across the lifespan of buildings

How much room do you need to swing Cat A?

Larger tenancies potentially generate less Cat A waste as they stay in an office space for longer

This study is based on an average lease length for a small office in the City of London from 2019-2023. **Table 4** shows that 80% of lease transactions in the City of London are under 10,000 square feet, and between 61% and 88% of lease transactions in other central London locations are under 10,000 square feet.

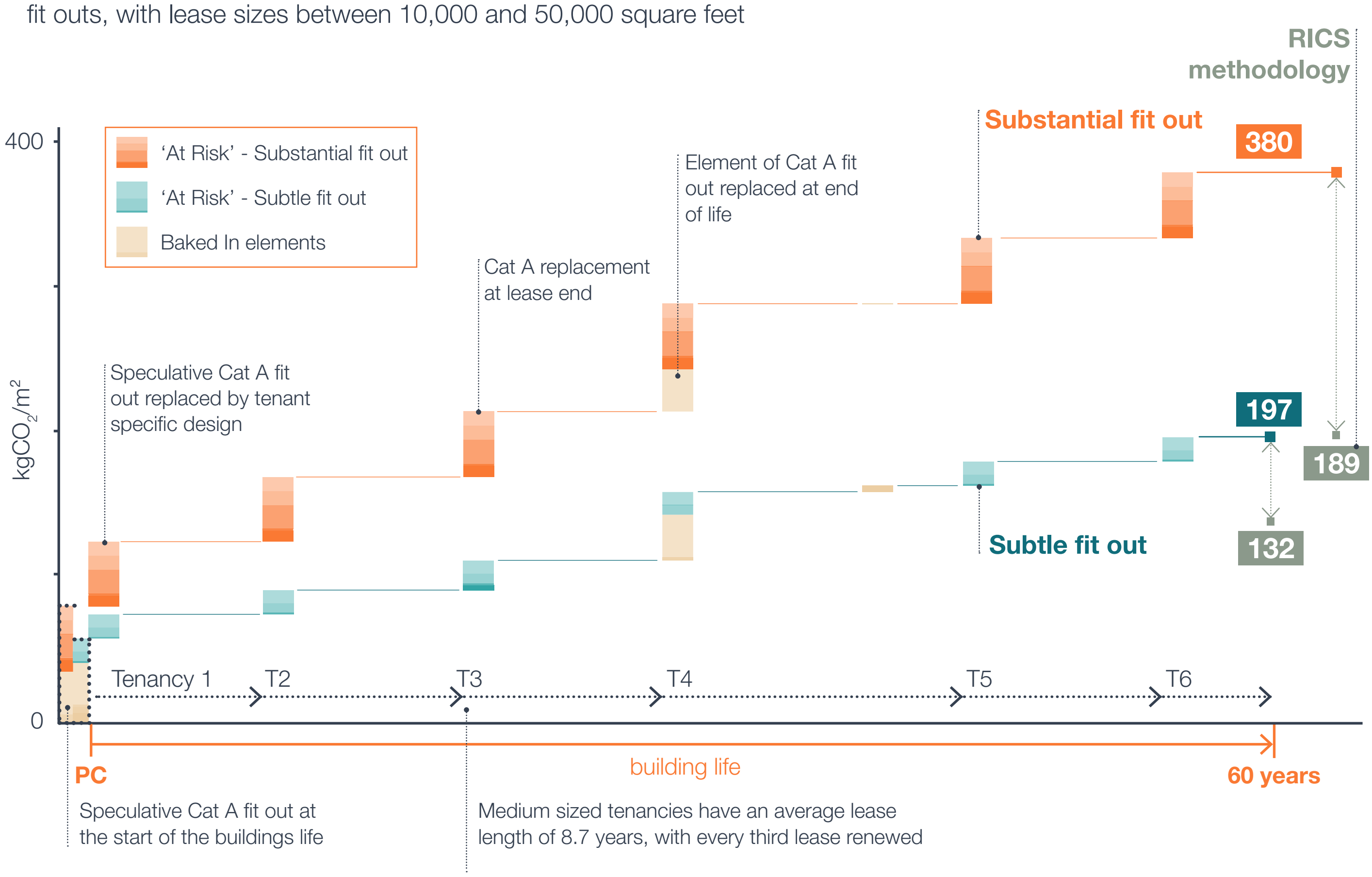
Larger organisations require more space and typically stay in one location for longer. Naturally, with longer lease lengths, there will be fewer fit out-rip out cycles, and subsequently less waste.

To explore the potential impacts of larger scale offices, the carbon emissions for both the Substantial and Subtle models have been calculated. Potential fit out-rip out cycles have been scaled to a medium office (10,000-50,000 square feet) with an average lease length of 8.7 years (from 2019 to 2023) shown by **Figure 16**, and for a large office (50,000 square feet and above) with an average lease length of 13.2 years (from 2019 to 2023) in **Figure 17**.

Predicted carbon emissions for the Substantial model reduce from 470kgCO_2/m^2 for a small office, to 380kgCO_2/m^2 for a medium office, and to 262kgCO_2/m^2 for a large office.

// Figure 16

Comparison of potential tenant fit out-rip out pattern for Subtle and Substantial fit outs, with lease sizes between 10,000 and 50,000 square feet



The Subtle design demonstrates a similar fall off in predicted carbon emissions with increasing tenancy size, reducing from 231kgCO_2/m^2 for a small office, to 197kgCO_2/m^2 for a medium office and 157kgCO_2/m^2 for a large office.

Figure 17 shows that alongside the 'Baked In' elements that naturally get replaced at end of life (as with small and medium models), some of the 'At Risk' elements are potentially being replaced at their end of life during a tenancy and again shortly after with the next tenant.

While there is still a discrepancy between the predictions made using *AHMM's Delivering Net Zero Toolkit* and the RICS methodology, the longer lease lengths result in a total carbon emission number that is much lower than the predictions for small offices with an average lease length of 5.1 years.

As highlighted in the previous section, the base build can be adapted to mitigate waste related to Cat A. Regardless of the base build design and lease length, landlords and agents can support tenants to take a more circular approach to their office spaces.

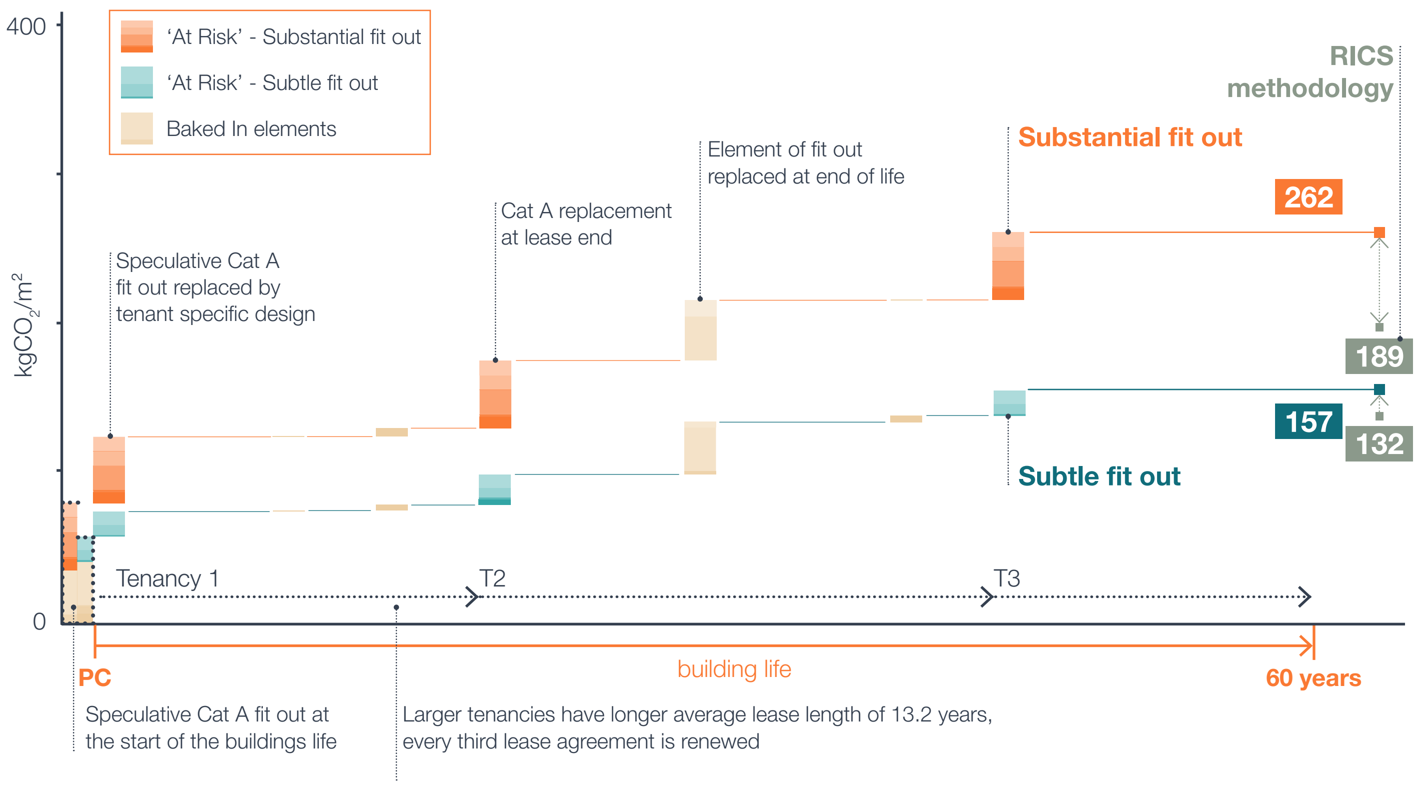
// Table 3
Lease length data (DeVono 2019 - 2023)

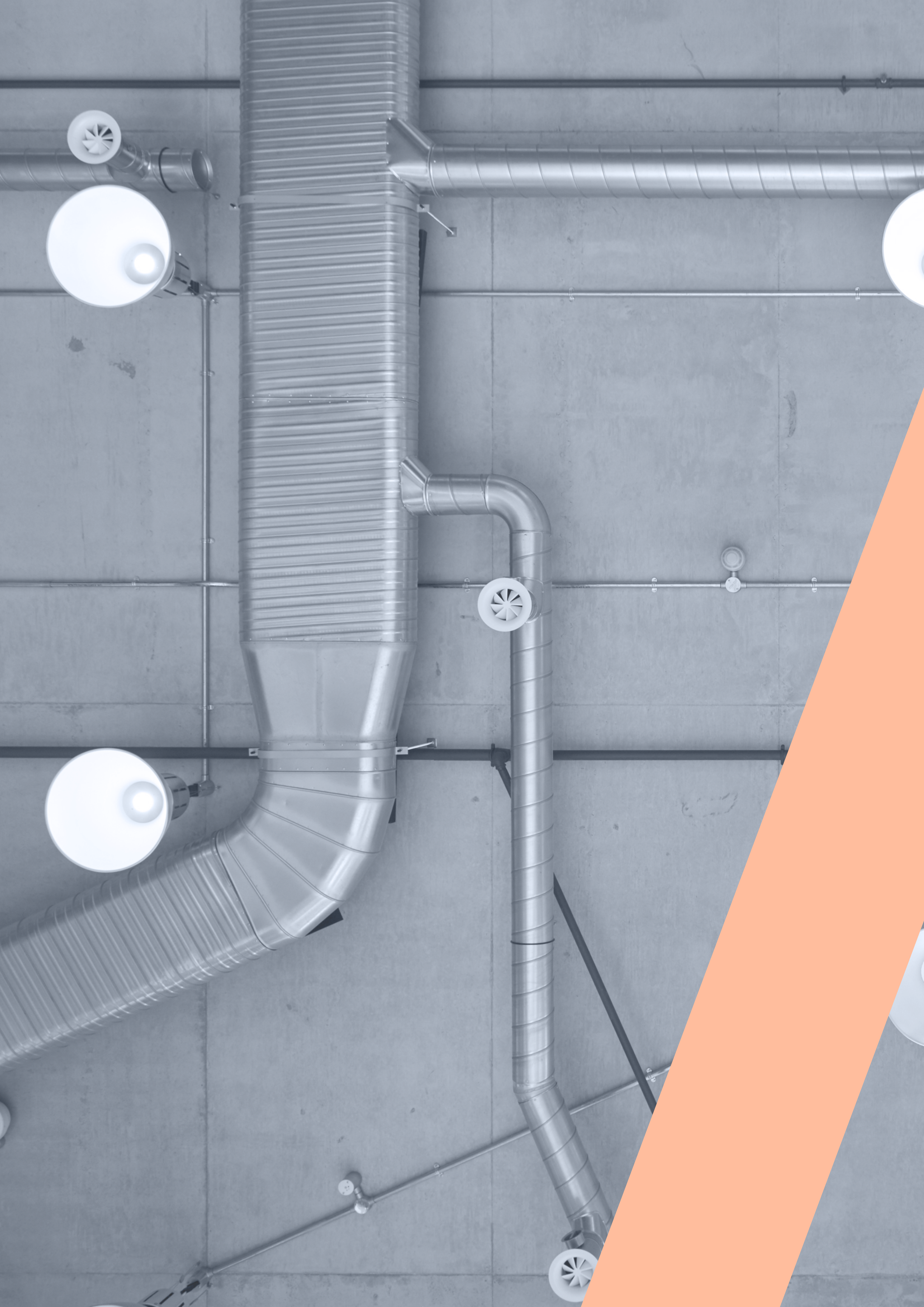
Lease Size	Average Lease Length
Up to 10,000 sq ft	5.1 years
10,000-50,000 sq ft	8.7 years
50,000 sq ft and above	13.2 years

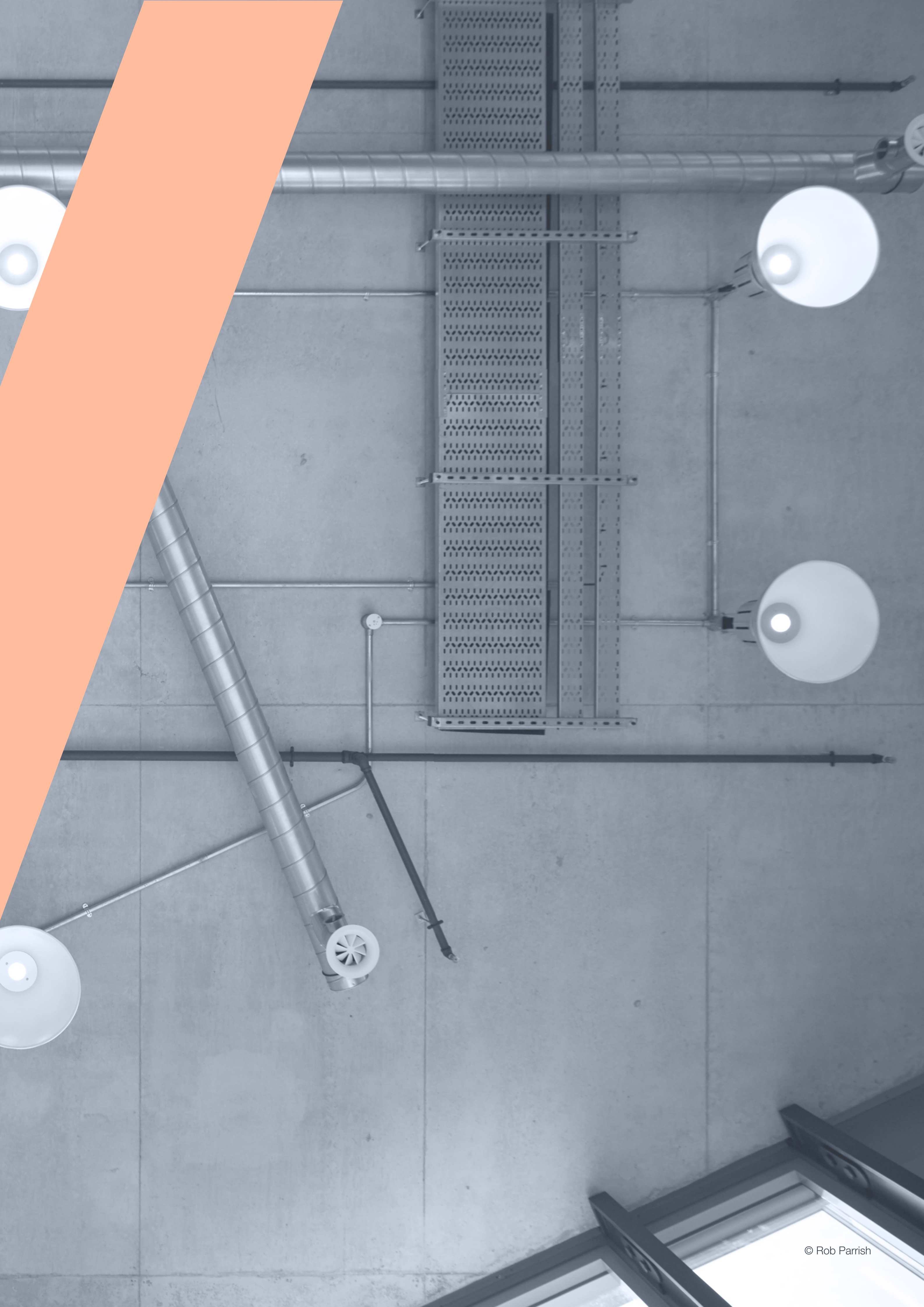
// Table 4
Lease transaction size data for the City of London (DeVono 2019 - 2023)

Lease Size	Share of Market
Up to 5000 sq ft	62%
5,000 - 10,000 sq ft	18%
10,000 - 50,000 sq ft	18%
50,000 - 100,000 sq ft	2%
100,000 sq ft and above	1%

// Figure 17
Comparison of potential tenant fit out - rip out pattern for Subtle and Substantial fit outs, with lease sizes above 50,000 square feet







Drivers

The existing Cat A paradigm has evolved in response to market needs and trends, which up until recently has not needed to address carbon. Now, it does.

The wasteful nature of Cat A is widely understood within our industry, but the cycle of fit out - rip out continues. Not only does this study quantifies the carbon impact of the industry standard approach to delivering speculative office space, but it also identifies the drivers behind the current paradigm.

The data gathered in this report demonstrates the role that design plays in reducing whole life carbon emissions related to Cat A fit out, and could help reduce Cat B waste and cost too. But, design alone will not solve the problem. The commercial office market is complex, with multiple stakeholders who often have differing interests. Alongside the quantitative data, conversations with developers, landlords, and agents have provided important qualitative feedback highlighting the intricacies of delivering, selling, and operating speculative offices, and insight into how this has developed in response to market requirements.

Marketing

A key driver for providing Cat A fit out is marketing: the goal when developing an office building is to attract and secure tenant lets. Agents confirmed that floor plates are easier to sell with full Cat A fit out as prospective occupiers can better visualise the potential of the space. A speculative fit out can also provide a sense of scale and light, which would otherwise be hard to imagine when presented with a raw, unfinished space. Some occupiers have dedicated teams to manage office leasing who may see the potential of a space that is not fully fitted out, and that can advise business leaders on the proviso that they will procure their own bespoke design. But many organisations are put off when presented with an unfinished environment and opt for a space that has an initial fit out already installed.

A speculative office that can appeal to as wide an audience as possible is an advantage when going to market. The longer an office remains unlet, the more money is lost, so it is in the agent's interest to secure tenants as quickly as possible. The speed of this sale is known as 'lease velocity'.

Lease velocity

If a vacant office has Cat A fit out, as soon as a lease is signed the office is 'ready to go', with incoming tenants theoretically only needing to install a Cat B fit out for their bespoke design and paying rent from day one. If the initial Cat A is ripped out and replaced, that is on the tenant's time. Not providing an initial Cat A would delay the point at which the tenant would start paying rent, as it is within their agreement to also procure the Cat A, a landlord responsibility. This is a disadvantage to the landlord.

Cost certainty

Some larger businesses look to sign a new lease with ample time before a planned office move. This scenario can give a landlord certainty on future rental yield of a new building and provides the opportunity to revise a planned Cat A fit out, but it is heavily dependent on timings. Depending on requirements, the landlord's Cat A fit out could be tailored to the future tenant's bespoke Cat B design or could be omitted altogether and left to be specified by the tenant themselves. The timescales for construction contracts often require materials to be ordered months, if not years, ahead of their programmed installation date, the advantage being that costs can be locked in and landlords are protected from price inflations later down the line. So, if a tenant signs a lease agreement after the materials have been ordered, it is often too late to omit the speculative Cat A fit out, whether the tenant wants it or not.

Where Cat A fit out is not installed by the landlord, a cash contribution is typically offered to tenants at the point of occupation, for them to procure and install a full fit out of their own requirements. However, this could leave landlords open to risk, if costs increase beyond the agreed sum during the construction period and the tenant expects to be reimbursed for this uplift. This gives very little financial incentive for landlords to omit Cat A fit out, even if they expect it to be ripped out at a later date by incoming tenants.

Market perceptions

Decisions around the type of Cat A required can be influenced by the perception of what can be easily adapted by future tenants. For example, it is typically believed that highly partitioned offices are served best by Cat A designs illustrated by the Substantial case study, with suspended ceilings seemingly offering the flexibility to easily install and adapt partitions. In reality, a more pared back design such as the Subtle case study can be highly flexible and potentially more adaptable than the more traditional approach. With no suspended ceilings to work around, cellularising space can be done efficiently and with minimal waste.

Dilapidation clauses

When Cat A is provided in a speculative office space, landlords ask for the space to be returned to them in the same usable condition at the end of their tenancy period. This has traditionally been covered by a dilapidation clause within tenancy agreements. Fulfilment of this clause has historically resulted in an outgoing tenant removing their bespoke fit out and re-installing Cat A to the landlord's original specification. This approach carries the same risk as the marketing Cat A fit out, which simply gets ripped out again by the next incoming tenant, and compounds the already significant impact of tenant turnover on life cycle carbon.

While dilapidation clauses are still fulfilled in some situations, developed markets have alternative solutions in place for longer tenancy agreements. A landlord accepts a cash contribution from an outgoing tenant to cover the cost of the new Cat A fit out. This approach has the potential to avoid an unnecessary Cat A fit out, if the landlord chooses to refurbish the space. However, this relies on the landlord and incoming tenant both agreeing to reuse and adapt the existing fit out, which may not be seen as viable or a desired option for a new bespoke design.

Warranties

As well as the complexities associated with designing to incorporate existing elements, reusing fit out can also be considered higher risk. Product warranties and service life restrictions deter people from reusing fit out elements, especially if the items only have few years of use at the end of a tenancy. The problem is further compounded with the risk of warranties becoming void if products are reinstalled in a different way to the original fit out. Brand new items carry less risk.

Conversations with the industry have confirmed that the pattern of Cat A fit out - rip out is shaped by the choices of many stakeholders. The industry practices have emerged to serve specific aspects of delivering or managing speculative office space, each approach being established and honed to best serve its own purpose. However, the sum of these practices is driving a wasteful, carbon intensive sector of the real estate industry. These well established practices must now be re-evaluated in the context of the climate emergency.

So, what

The future model for Cat A must be shaped to respond to the climate emergency, align with our aspirations for a circular economy, and continue to provide value to the real estate market, while creating uplifting spaces places people want to be.

Stop speculative fit out once and for all

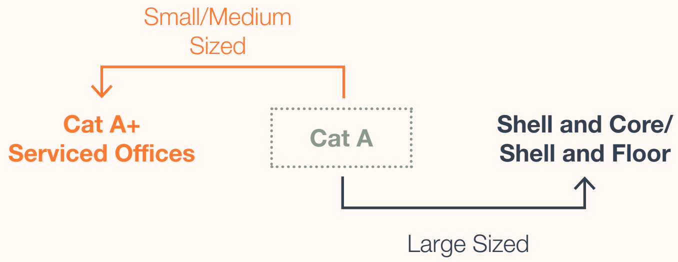
The most immediately impactful action to reduce the life cycle emissions that result from the Cat A fit out - rip out cycle, would simply be to stop delivering speculative office Cat A fit outs. But what are the viable, sustainable alternatives that will still meet the needs of the various stakeholders in the commercial real estate market?

With Virtual Reality (VR) and Augmented Reality (AR) technology improving year on year, these tools not only have the ability to show a space delivered to Cat A specification, but they also have the potential to bring to life a tenant specific Cat B fit out, even including customisable marketing material for each potential client at the touch of a button. Digital visualisation could also be supported by ‘show offices’, in the same way show homes exist in the residential real estate market, so agents can still provide a comprehensive demonstration of an office space.

As occupiers with ambitious environmental, social and governance (ESG) targets demand the most sustainable buildings and offices for their employees, the carbon savings from not having extensive Cat A fit out and a space that can be easily and cheaply adapted for Cat B could be seen as a boon when reporting carbon credentials in marketing materials.

Fully serviced offices have disrupted the market in recent years. While some co-working providers have not survived after their initial market disruption, this type of office solution is still in demand. Highly flexible and with very short lead times to occupation, serviced offices are particularly popular with smaller tenants. Often referred to as ‘Cat A+’, the integrated design of services ensures a fully coordinated fit out, with no waste generated from ripping out an unsuitable Cat A fit out. Serviced offices initially appealed more to businesses requiring 5,000 square feet or less, but are now attracting a growing number of business requiring up to 10,000 square feet of space.

Appealing to a wide audience is key when marketing commercial office space, but a solution to this could be for landlords to provide a diversified offer, rather than a blanket Cat A solution. For example, a landlord could present some floors as ‘shell and core’ or ‘shell and floor’ for businesses that have more of an appetite to procure and design a fully customised fit out, and other spaces that are specified to Cat A+ or Cat B for those that want something more ‘ready to go’.



do we do?

Providing the two different options within one building can create long term efficiencies. When creating the bespoke fit out, not having an existing, unsuitable Cat A to decommission or adapt can expedite the eventual fit out meaning tenants can occupy the office sooner. Additionally, removing the need to deliver the Cat A fit out on these floors means the landlord and agent saves programme time and increases lease velocity. Fully fitted floors have the advantage of being ready to move in to for businesses wanting a shorter lead time to occupation, again potentially reducing the amount of time that floor plates are unlet.

In projects where a speculative Cat A fit out may still be required, contracts can be structured to give the maximum window of opportunity to omit Cat A at a later stage. This allows agents to discuss tenant requirements at the pre-let stage whereby a mutually beneficial agreement is made regarding the inclusion or omission of Cat A fit out.

On the other hand, where a tenant installs Cat A alongside their Cat B fit out, decisions over ownership of the Cat A and the resultant carbon emissions need to be agreed upon by the tenant and landlord parties. Possible models for this are suggested below:

1. The landlord makes a cash contribution to the tenant for Cat A and B fit out, the tenant taking ownership of all elements. The landlord can then take a maintenance and refurbishment payment from the tenant at the end of a tenancy, or include this within the rent.

2. The landlord makes a cash contribution for Cat A fit out, with the tenant covering Cat B costs, as is typically done. This split ownership model means carbon responsibility can be more difficult to track.

3. The tenant owns all fit out, including Cat A, with no initial cash contribution made by the landlord. The rental value reflects the space being delivered to tenants as Shell and Core. The tenant is responsible for the carbon, reporting these numbers to the landlord.

Formalise tenant fit out in WLCA models

As this study illustrates, tenant choices around Cat A and Cat B fit out can heavily contribute to the carbon emissions of a building. Reporting the life cycle carbon emissions of a building (including Cat A) is the responsibility of the building owner, while the carbon reporting of the Cat B fit outs are the responsibility of the tenants. Additionally, the building's design, delivery, and construction can influence how it performs and supports adaptations over the course of its life.

The RICS industry standard reporting method recognises the short lifespan of fit outs when calculating for interior fit out projects in isolation, for example when a tenant calculates whole life carbon (WLC) when moving into an office. RICS specifies the expected life expectancy, or 'Reference Study Period' (RSP) of a fit out as ten years. However, the RICS methodology does not consider the effect of these short lifespans in the wider context of the building's WLC.

Without a holistic view of the various contributors to a building's carbon emissions, it is almost impossible for landlords, tenants, or architects to take the actions needed to reduce this. Introducing a formal distinction between tenant and landlord demise within the WLC reporting structure would provide clarity for reporting purposes.

As shown with the case study calculations in this report, articulating the spaces in this way not only helps to clarify the upfront carbon at the point of practical completion, but when paired with a realistic RSP cycle it also can create a more detailed picture of the future impacts of fit out changes over the life of a building.

In turn, this will enable architects to make informed decisions for the base build design that supports the management and use of the building while in operation to minimise whole life carbon impacts.

Recentre the industry's focus on circular solutions

Landlords are in an influential position in the commercial fit out industry. Landlords can create a culture and ecosystem within a building that tenants understand and contribute to. They can build relationships with incoming and outgoing tenants to ensure this lasts over the life of a building. From this vantage point, landlords are uniquely positioned to start to close the loop of a historically linear process. Vital to this will be reimagining the contractual relationship between landlord and tenant.

If a tenant comes into the space and does not want to use the in-situ Cat A fit out provided, the landlord should have the opportunity to retain the items rather than them being discarded. These same items could then be reused between future tenancies if required. This would require additional consultation with manufacturers to ensure product viability and warranty for reuse.

Rigid dilapidation clauses have historically fuelled the linear economy of the fit out - rip out cycle. While many outgoing tenants still restore the office space to Cat A fit out in accordance with their contract, it is becoming more common for outgoing tenants to fulfil the agreement by providing a cash equivalent to the landlord. Further development of this transaction could play a pivotal role in finding a potential solution. 'Green leases' could evolve to incorporate clauses that require landlords and tenants to undertake specific responsibilities and obligations to minimise carbon emissions. Clauses could be built into these agreements that facilitate the reuse of existing fit out materials with cash contributions going to the landlords to refurbish and renew, rather than replace. Outgoing tenants would be able to leave their fit out in place, while passing on materials, information, and warranties that the landlord and/or incoming tenant could repurpose.

One of the fundamental issues with reuse is how materials are viewed after their first use. Once a product or material is uninstalled, its warranty typically becomes void, even if it has only just been installed. After use, products and materials may also automatically be classified as waste unless specifically marked for reuse, the latter should be written into usage requirements so products and materials are carefully removed and stored to maintain their value.

These solutions sound promising, but making them work in practice would involve a mindset change across the industry. Fit out design needs to be recentred around circular principles, with disassembly and adaptation prioritised.

Encourage and incentivise adaptable fit out

The analysis of the four case studies in this report demonstrates how different models of Cat A fit out can influence the upfront and whole life carbon emissions of a building. The four case studies were categorised as Substantial, Significant, Slender, and Subtle, based on the percentage of elements that were considered 'Baked In' or 'At Risk'. The results show how these four models of Cat A perform over the life of a building, particularly in relation to the fit out - rip out cycle, and how this impacts predicted life cycle carbon emissions. By introducing the classification of 'Baked In' vs 'At Risk' into fit out design, another layer of information is available to inform decision making at design stage, enabling teams to holistically consider the whole life carbon impacts of early design decisions.

Ideas of pared back finishes and exposed services have been gaining traction over recent years, with AHMM's White Collar Factory [10] demonstrating the success of the 'self finished structure' within an office environment. These moves have been influenced by a growing understanding of sustainable design and the desire to reduce unnecessary decorative materials in the process. This has historically been a less popular aesthetic in some office markets, however, the data in this report shows how a pared back 'look and feel' has the benefit of also being low carbon. A characterful base build paired with a purposeful Cat A fit out also encourages more minimal Cat B fit out when tenants come to personalise their space. All of this can be marketed as good choice for tenants with ambitious ESG targets.

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The cat (A) is out of the bag

Seeing jarring images of brand new office fit out being ripped out weeks after a building achieved practical completion was the catalyst to investigate why the fit out - rip out practice of Cat A continues, even though the real estate industry understands how wasteful it is.

This report used *AHMM's Delivering Net Zero Toolkit* to measure the carbon emissions associated with Cat A fit out and aimed to understand the established industry patterns that generate the associated unnecessary waste.

The study unearthed that the carbon emissions associated with this waste are generally unaccounted for, even though they contribute a significant proportion of whole life carbon emissions. Conversations with industry experts helped to identify that the drivers of the current practices centre around value and risk; supply chains, contract types, sales and marketing, rental agreements, and dilapidation clauses are some of the key contributing factors.

Until now, the lack of data has resulted in a lack of clarity about the scale of the Cat A problem. As a result, it has been difficult to find viable solutions to solve the issue.

This report has quantified the potential carbon impact of Cat A and shone a light on the driving forces keeping the practice in place. There needs to be an industry wide mindset change to reform the complex paradigm that is Cat A fit out. Critically, value must be found within the new ways of working, for stakeholders in the industry as well as for the future of the planet.

The report introduces ideas that go towards addressing this through workable and practical new programmes and business models. There is a real opportunity for the great minds of the built environment industry to come together to develop these ideas and solve the problem of Cat A.

Now that the cat (A) is out of the bag, there's no excuse not to.

// This report has come to an end, but the conversation certainly has not.

Get in touch, we'd like to talk

CONTACT HERE

References

1 **Delivering Net Zero In Use: A Guide for Architects**
https://www.ahmm.co.uk/profile/sustainability/delivering-net-zero-in-use-toolkit

2 **UK Architects Declare Practice Guide**
https://www.architectsdeclare.com/uploads/AD-Practice-Guide-2021-v1_3.pdf

3 **RIBA 2030 Climate Challenge**
https://www.architecture.com/about/policy/climate-action/2030-climate-challenge

4 **LETI Climate Emergency Design Guide**
https://www.leti.uk/cedg

5 **BCO Guide to Specification**
https://www.bco.org.uk/Research/Publications/BCO_Guide_to_Specification_Key_Criteria_Update_February_2023.aspx

6 **RICS Whole Life Carbon Assessment for the Built Environment, 2nd edition**
https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment

7 **CIBSE TM65 Embodied carbon in building services: A calculation methodology (2021)**
https://www.cibse.org/knowledge-research/knowledge-portal/embodied-carbon-in-building-services-a-calculation-methodology-tm65

8 **DeVono**
https://www.devono.com

9 **BNP Paribas Real Estate and MSCI Lease Events Review**
https://www.msci.com/www/research-report/uk-lease-events-review-november/01157024235

10 **White Collar Factory**
https://www.ahmm.co.uk/projects/office/white-collar-factory

Fit Out // Rip Out

A Study on the
Carbon Cost of Cat A

ALLFORD
HALL
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