BCO

British Council for Offices
September 2022

THE FUTURE OF UK OFFICE DENSITIES

ABOUT THE BCO

The BCO is the UK's leading forum for the discussion and debate of issues affecting the office sector. Established in 1990, its membership base comprises organisations involved in creating, acquiring or occupying office space, including architects, lawyers, surveyors, financial institutions and public agencies.

The BCO recognises that offices don't just house companies, they hold people and so what goes on inside them is paramount to workplace wellbeing.

ACKNOWLEDGEMENTS

The BCO and the authors would like to thank all those who contributed to this research through interviews and participating in the survey. A list of those who participated in the interviews and workshop is given on page 29.

ABOUT THE AUTHORS

This report was written by Nigel Oseland (Director at Workplace Unlimited), Roderic Bunn (Inhabit and UCL Institute for Environmental Design and Engineering), Tim Oldman (Leesman Index) and Michael Hadcocks (Senior Researcher at Leesman). Full biographies of the authors are given on page 28.

COVER IMAGE *Copyright AECOM*

CITATION

Nigel Oseland, Roderic Bunn, Tim Oldman and Michael Hadcocks (2022). *The Future of UK Office Densities*. http://www.bco.org.uk/Research/Publications/The_Future_of_UK_Office_Densities.aspx

British Council for Offices (2022). *The Future of UK Office Densities*. http://www.bco.org.uk/Research/Publications/The_Future_of_UK_Office_Densities.aspx

COPYRIGHT © BRITISH COUNCIL FOR OFFICES, 2022

All rights reserved by British Council for Offices. No part of this publication may be reproduced, stored or transmitted in any form or by any means without prior written permission from the British Council for Offices. The BCO warrants that reasonable skill and care has been used in preparing this report. Notwithstanding this warranty the BCO shall not be under liability for any loss of profit, business, revenues or any special indirect or consequential damage of any nature whatsoever or loss of anticipated saving or for any increased costs sustained by the client or his or her servants or agents arising in any way whether directly or indirectly as a result of reliance on this publication or of any error or defect in this publication. The BCO makes no warranty, either express or implied, as to the accuracy of any data used by the BCO in preparing this report nor as to any projections contained in this report which are necessarily of any subjective nature and subject to uncertainty and which constitute only the BCO's opinion as to likely future trends or events based on information known to the BCO at the date of this publication. The BCO shall not in any circumstances be under any liability whatsoever to any other person for any loss or damage arising in any way as a result of reliance on this publication.

CONTENTS

EXECUTIVE SUMMARY	4
BACKGROUND	6
RESEARCH APPROACH	8
REVIEW OF THE IMPACT OF HIGH DENSITIES	9
IMPACT OF DENSITY ON OFFICE OCCUPANTS	11
CHANGING WORK PATTERNS AND OCCUPANCY LEVELS	16
FUTURE OFFICE DENSITIES	19
RELEVANT OFFICE DENSITY METRICS	21
RECOMMENDATIONS FOR THE BCO GUIDANCE	23
REFERENCES	26
ABOUT THE AUTHORS	28
ACKNOWLEDGEMENTS	29

© BCO 2022

EXECUTIVE SUMMARY

The world of work and the workplace is continuously evolving, and this has been particularly true over the last few years. This has led occupiers and their advisors to reconsider the future use, design and space planning of their offices. The BCO therefore commissioned research that will offer advice to BCO members on how to determine their appropriate office density in the near future, and to inform the future versions of the BCO's *Guide to Specification*[1] and *Guide to Fit-Out*.[2] Such advice needs to consider changes in office densities in response to the:

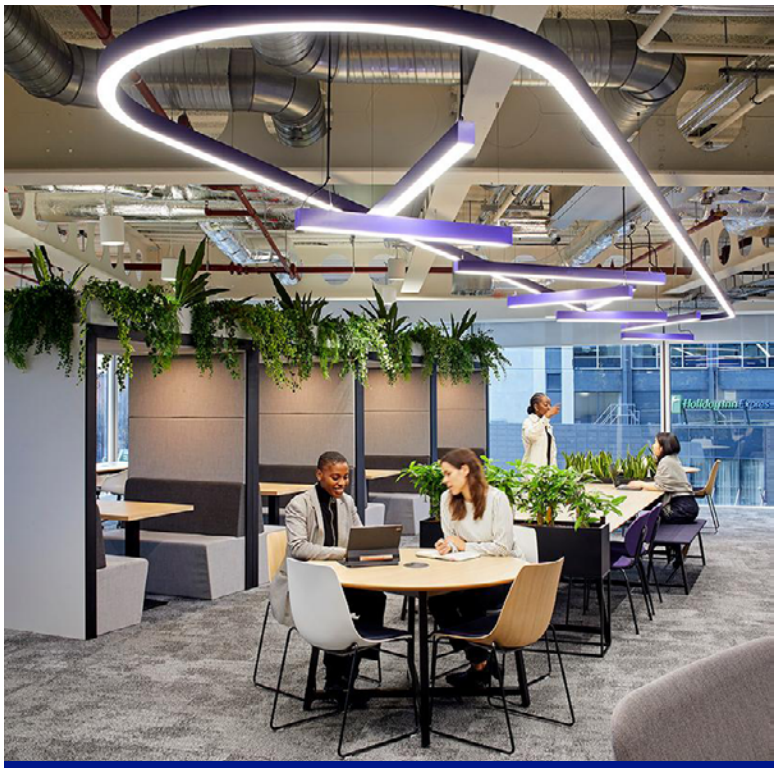
- impact of the over-densification (<8 m² per person) of UK offices on performance and wellbeing
- onset of the COVID-19 pandemic and occupant expectations post-pandemic, in terms of the desk layout, balance of work settings and work patterns
- need to create sustainable offices that help meet the UK's net zero carbon targets for 2050 and reduce 1990 emissions by 78% by 2035.

Back in 2001, the average density in UK offices was approximately 14.8 m² per desk on a typical floor, whereas in 2018 the average density was 9.6 m² per desk. This increase in density over 17 years equates to approximately 36%, equivalent to losing two standard desks per person. Other surveys have shown that UK office densities are among the highest worldwide, and much higher than densities in Northern European countries.

The research evidence was gathered from various quantitative and qualitative sources, and then triangulated to generate our recommendations. In addition to a high-level literature review, we conducted in-depth analysis of a longitudinal dataset and detailed analysis of the Leesman Index database.[3] However, the analysis of such legacy datasets is retrospective, so we sought the views on future densities of industry experts, occupiers and developers through 18 interviews, and obtained the views of the wider BCO membership through an online survey, with 202 completed responses.

The literature review revealed that relatively few studies have specifically explored the impact of workplace density. Those studies that have been done show that high-density environments affect comfort, wellbeing and performance. However, in many of the studies carried out in real offices, rather than simulations, the relationship is weaker than might be expected, due to confounding factors that operate in real environments. Factors include workspace features and typologies, including the distance between desks, height of desk screens, size of open space, number of people in one space, layout of desks, level of partitioning between clusters of desks and access to private workspace. It is also affected by organisational factors such as culture, tenure, gender and job complexity. Work-related factors, such as work patterns, work activities and agile working, also determine the effects of density on people.

Nevertheless, the research indicates that in offices with lower densities, and more than 12 m² per person on a main office floor, it is likely that most workspace issues and concerns are alleviated. In contrast, higher office densities, of less than 8 m² per person, are more likely to cause issues and affect occupant comfort, wellbeing and performance for most organisations. The impact of high density may be mitigated but requires good design investment in the workspace and careful management of it.



3 Snowhill, Queensway, Birmingham
Copyright tp bennett and Hufton+Crow

Overall, our findings suggest that, rather than a single density figure, guidance on key factors that impact on space and density is required to enable users of the BCO *Guide to Fit-Out* and *Guide to Specification* to determine their own relevant density. However, those consulted also like a ballpark (rule of thumb) density figure as a starting point. Buildings are likely to operate at a range of densities, but the literature and our survey indicate that a range of 10–12 m² per person is more acceptable, and for planning densities for base-build and fit-out purposes a ballpark starting point of 10 m² per person appears to be reasonable for a typical working floor net internal area (NIA).* This starting density will need to be adjusted for factors such as the organisation's activities and the space needed to support them, and the level of support (non-desk) spaces and amenities provided for employees.

In our research, most of the organisations surveyed reported mid-week peaks in occupancy levels of 70% ± 10%. These peaks will need to be managed so that they are levelled out; alternatively, the BCO guidance will need to allow for such peaks. Workplace strategy and workstyle also affect occupancy levels. The range is approximately 70% ± 10% for traditional (1:1 allocated desks) offices and 50% ± 10% for agile-working environments.

The density metric needs to be consistent, but currently several metrics are referred to in the BCO guides. Our research

* Net internal area (NIA) is the usable floor area within a building measured to the internal face of the perimeter walls on each floor; it includes primary circulation routes but excludes lobbies, atria, toilets, stairwells, elevators, plant rooms, columns and ducts, etc.

© BCO 2022

indicates a preference for 'm² per person', which accounts to some degree for variations in occupancy levels and hot-desking. Likewise, the 'desk' or 'workstation' metric is less relevant to today, as more organisations have adopted agile and activity-based working with a mix of desks and alternative work settings that occupants may use for part of the day. Our survey indicates that measured density is used the least in relation to the immediate desk area, even though it probably best reflects occupant perception. However, equal numbers of those surveyed are in favour of relating density to a typical working (main office) floor or the whole building.

Caution is required when comparing the main office floor density with the whole-building density, which is traditionally used by the real estate industry. Likewise, there are differences in density figures based on the NIA and the net usable area (NUA).** To allow for the primary circulation, the NUA is typically 80–85% of a typical working floor, and so densities based on the NIA will appear more generous to those more familiar with using NUA figures. As the NIA includes primary circulation and support spaces as well as desk areas across the floor, it does not capture variations in density. For example, the floor density figure may hide or dilute pockets of high-density desk areas.

The starting density could be adjusted for the planned occupancy level, which in turn will be affected by the working patterns. Our research indicates that an average 50% occupancy level could be used, but contingency is required for the higher 80% mid-week peaks or for higher utilisation of desks due to hot-desking. Alternatively, lower performance, such as lift waiting times, will need to be accepted. The issue with using occupancy levels to determine the density is how they can be accurately predicted for planning and then managed to prevent overcapacity of the building. The building infrastructure should perhaps allow for 70% ± 10% default occupancy levels on typical working floors. However, some floors, like conference suites, may have excess visitors and on occasion exceed 100% occupancy. It is better to manage and plan for lower density but highly utilised workspaces.

Riverside House, New Bailey, Irwell Street, Salford
Copyright Muse Developments

Our research indicates that the real estate portfolio footprints of many organisations will reduce as a consequence of the global pandemic, as will their office space requirements. Such organisations are adopting agile/hybrid working models such that most employees will not have assigned desks in their offices. Further analysis reveals a strong trend towards offices being designed for increased 'connection', which affects the traditional space distribution between desk areas and alternative work settings.

With some occupiers reducing their required footprints, it follows that those supplying larger developments and office buildings may find they are under increasing pressure to subdivide floors as space requirements universally decrease. Design teams should therefore consider the impact of this on central services and the use of common parts. ■

** Net usable area (NUA) is the NIA minus the primary circulation route.

© BCO 2022

BACKGROUND

RESEARCH OBJECTIVE

The world of work and the workplace is continuously evolving, and this has been particularly true since the onset of the COVID-19 pandemic. The pandemic has led occupiers and their advisors to reconsider the future use, design and space planning of their offices. In particular, work patterns and the balance of work activities in the office have changed, and guidance is required on how the design and operation of offices need to respond to this change. While some companies have long implemented agile working and its variations (e.g. smart, activity-based and new ways of working), others have found that the pandemic has accelerated their adoption of agile and hybrid working.

The BCO commissioned Nigel Oseland, Roderic Bunn, Tim Oldman and Michael Hadcocks to conduct research that will enable the BCO to offer advice to its members on how to determine their appropriate office density in the near future, and will inform the future versions of the BCO's *Guide to Fit-Out* and *Guide to Specification*. This report summarises that research and the relevant findings.

EVOLVING DENSITIES

Previous BCO research and reports have indicated that UK offices have been gradually densifying. In 2001, Gerald Eve[4] reported the average density in UK offices to be 16.3 m² per desk across the whole-building NIA, equivalent to approximately 14.8 m² per desk on a typical floor.*** More recently, in 2018, the BCO report *Office Occupancy: Density and Utilisation*[5] found an average of 9.6 m² per desk across the NIA of a typical working floor. The difference in office density over those 17 years equates to approximately 36%, which is equivalent to losing two standard desks per person. However, as Figure 1 shows, the BCO benchmarks indicate that the density in UK offices is levelling off. Some may consider this levelling off as inevitable because there is a limit to how far space can be squeezed before it becomes problematic.

The Leesman Index includes a subset of 74 Leesman+ buildings† worldwide in which the spatial density has been calculated. The six of those buildings that are located in the UK have densities in the range 7.5–14.6 m² per desk (average 10.2 m² per desk), which is not too dissimilar to the BCO findings. In this small but unique dataset, the UK had the third highest density. Across the full dataset, the average density is 14.5 ± 5.8 m² per desk. Workplace conferences often share aspirational case studies from Northern Europe. Figure 2 shows that the UK buildings in our sample are, on average, approximately 16 m² per desk denser than the Northern European buildings. Similarly, in 2020, JLL[7] found that London office densities were the fourth highest compared to other cities worldwide, with offices in Asian cities having higher densities and American offices offering around twice the space per person. On face value, it appears that UK office densities are much tighter than those in other countries. While space efficient, research indicates that such densities may have undesirable consequences for occupant wellbeing and performance.

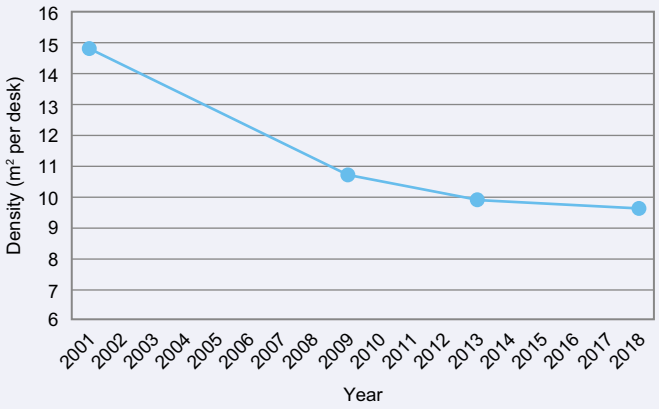


Figure 1
Benchmark density in UK offices over time

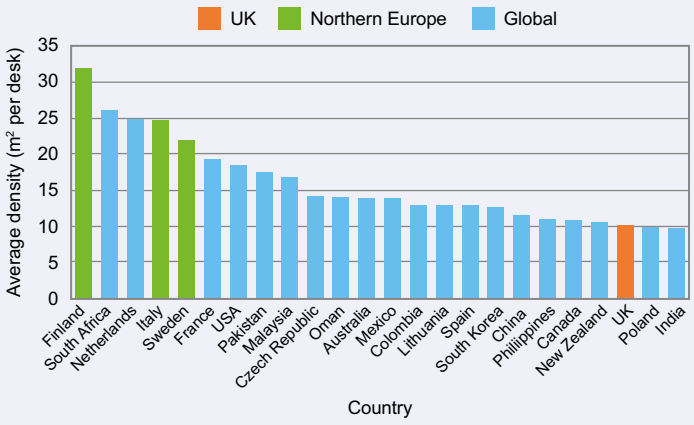


Figure 2
Average density in UK offices compared to other countries (analysis of 74 Leesman+ accredited buildings from 2010 to Q1/2022)

The 2019 version of the BCO *Guide to Specification*[1] recommended a workplace density of 8–10 m² NIA per workspace for on-floor services design, and an effective density of 10–12.5 m² NIA per person for core design elements.

Effective density takes into account the utilisation (percentage occupancy levels) of the office, and 80% utilisation was applied to the workplace density to derive the recommended effective densities. The range in these figures is because the BCO guide distinguishes between typical and high-density offices:

> *For many office buildings, a workplace density of 10 m² per person is adequate … For intensively used offices, a workplace density of 8 m² per person may be used to provide best flexibility for a wider range of occupiers.*[1]

In terms of effective density, for typical offices '12.5 m² per person is used for core design elements related to occupier usage' and for high-density offices '10 m² per person can be used for core design elements'.[1]

*** The 2001 Gerald Eve data[4] was adjusted using the floor area to building ratios used in BCO reports.

† The Leesman+ certification is awarded to top-tier workplaces that have achieved an Lmi of 70 or above, providing a precedent for organisations around the world.[6]

© BCO 2022

The 9.6 m² per desk for a typical working floor found by the BCO back in 2018, and the 10.2 m² per desk found by Leesman,[6] could be considered pre-pandemic benchmarks. The big question is whether such figures are valid post-pandemic. The risk of cross-infection, the temporary regulations on spacing between people and the health concerns of workers returning to the office mean that such planning densities may be considered to be too tight. Furthermore, many recognise that expecting an office to support higher densities requires additional building services, which increases embodied and operational energy demands. The UK has adopted a legally binding net zero carbon target for 2050, and an interim target to reduce 1990 emissions by 78% by 2035. If buildings are designed to support densities that are never realised in practice, due to, say, lower occupancy levels, then unnecessary energy is being used and needless excessive carbon emissions produced. The alternative of building fewer offices that will be occupied at higher densities may reduce carbon emissions, but it is more likely to degrade worker performance and wellbeing. It is better to manage and plan for lower density but more highly utilised workspaces.

In its 2022 position paper,[8] the BCO proposed changes to the key criteria in the BCO guides to better reflect the UK Green Building Council (UKGBC) operational and embodied energy targets, and also the changing patterns of office use. The proposed revisions to the guides are intended to discourage overprovision and support the drive towards net zero carbon. For example, the paper proposes that the high-density occupancy of 8 m² NIA per work setting is withdrawn and that the effective workplace density for core design elements of 12.5 m² NIA per person is replaced with 16.7 m² NIA per person. The proposed changes to the guides reflect new working patterns and occupancy levels. The original effective density of 12.5 m² per person was based on 10 m² per workspace and 80% utilisation, whereas it is recommended that the utilisation is reduced from 80% to 60%, reflecting typical office usage rather than extreme levels, which results in the effective density figure of 16.7 m² NIA per person. A key objective of this report is to inform the proposed changes to the BCO's design criteria. ■

215 Bothwell Street, Glasgow
Copyright Cooper Cromar

© BCO 2022

RESEARCH APPROACH

Our approach to the research was to gather evidence from various quantitative and qualitative sources, and then triangulate and interrogate our findings to arrive at recommendations (Figure 3).

In addition to a high-level literature review, we undertook an in-depth analysis of a longitudinal dataset of seven offices and a detailed analysis of the Leesman Index database (which includes a subset of 74 buildings with measured density data).

However, the analysis of such legacy datasets is retrospective. Therefore, we sought the views about future office densities of industry experts, occupiers and developers through 18 interviews, and also obtained the views of the wider BCO membership through an online survey, from which we received 202 completed responses.

The core objective of this report is to inform future planning densities for UK offices by considering the:

- impact of over-densification (<8 m² per person) on occupant wellbeing and performance
- concerns of workers returning to the office with regard to cross-infection and health risks
- waste of energy and excess carbon emissions due to the overspecification of base-build components.

This report, which is aimed at informing future office densities, is broken down into the following sections:

- review of the impact of high densities
- impact of density on office occupants
- changing work patterns and occupancy levels
- future office densities
- relevant office density metrics
- recommendations for the BCO guidance. ■

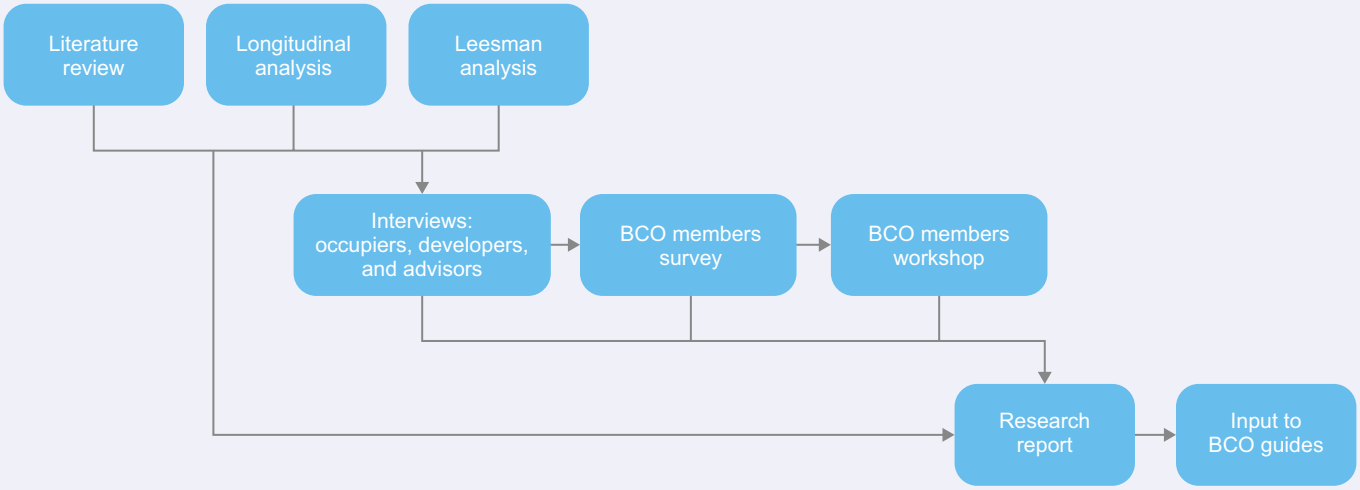


Figure 3
The research approach

© BCO 2022

REVIEW OF THE IMPACT OF HIGH DENSITIES

LEGACY RESEARCH

Open-plan offices have received much bad press over the last few decades, with claims that they are severely detrimental to performance and health. However, such publications tend to refer to poorly designed and ill-considered offices, which are over-dense with few partitions/screens and support spaces, rather than well-designed open-plan offices.[9]

In this section we highlight the evidence to support the effects of the over-densification of offices on occupant satisfaction, comfort, performance and wellbeing. Care has been taken to review studies of actual density, rather than studies that compare open-plan with more enclosed offices spaces.

LITERATURE REVIEW

About 50 papers were selected using a keywords search, and papers relevant to the impact of office density on workers and views on future office densities were reviewed. Duval et al.,[10] DeCroon et al.[11] and Davis et al.[12] provide pertinent reviews of the research literature on office densities. For example, DeCroon et al.[11] reviewed numerous studies, of which eight examined the effect of the distance between workstations on cognitive workload and other psychological responses. Similarly, Duval et al.[10] reviewed 19 papers on the impact of density on environmental satisfaction, but only 13 of these measured either social density (occupants per office) or spatial density (space per occupant). Consequently, we identified 23 relevant studies, either referenced in these three reviews or other relevant papers. A list of these studies is given in Table 1.

Some of the key studies on workplace density are referenced in all three reviews. For example, the three reviews all cite the studies by Oldham and colleagues. Most notably, Oldham[24] surveyed three open-plan offices of the same company and found that lower density open-plan workspace improved ratings of privacy, work satisfaction and environmental satisfaction, and reduced perceived crowding. In numerous other studies, Oldham and colleagues found that high density, with increased proximity of co-workers and relatively few physical screens

Research	Location	Variable	Effect
Bharucha-Reid and Kiyak (1982)[13]	Laboratory	Environmental satisfaction	Yes
Block and Stokes (1989)[14]	Office	Environmental satisfaction	Yes
Duvall-Early and Benedict (1992)[15]	Office	Privacy	No
Evans (1979)[16]	Laboratory	Crowding, comfort	Yes
Hedge et al. (1989)[17]	Office	Environmental satisfaction	Yes
Herbig et al. (2016)[18]	Office	Psychosocial work stressors	Yes
Fried et al. (2001)[19]	Office	Job satisfaction, commitment	Yes
		Co-worker satisfaction	No
Lange, Mueller and Donnerstein (1979)[20]	Laboratory	Concentration	Yes
Licina and Yildirim (2021)[21]	Office	Noise	Yes
May, Oldham and Rathert (2005)[22]	Office	Environmental satisfaction	Yes
Nagar and Pandey (1987)[23]	Laboratory	Crowding, comfort	Yes
Oldham (1988)[24]	Office	Cognitive workload, privacy	Yes
Oldham and Brass (1979)[25]	Office	Concentration, motivation, confidential discussion	Yes
Oldham, Kulik and Stepina (1991)[26]	Office	Environmental satisfaction	Yes
Oldham and Rotchford (1983)[27]	Office	Cognitive workload, communication, concentration, environmental satisfaction	Yes
		Communication, autonomy	No
O'Neill (1994)[28]	Office	Cognitive workload, privacy, environmental satisfaction	Yes
O'Neill and Carayon (1993)[29]	Office	Environmental satisfaction	No
		Privacy	Yes
Rishi et al. (2000)[30]	Office	Privacy	Yes
Sundstrom et al. (1980)[31]	Office	Crowding, privacy	Yes
Sundstrom et al. (1982)[32]	Office	Environmental satisfaction	No
		Privacy	Yes
Sutton and Rafaeli (1987)[33]	Office	Workstation satisfaction	No
Szilagyi and Holland (1980)[34]	Office	Communication	Yes
Zahn (1992)[35]	Office	Communication	No

Table 1
Summary of reviewed studies

© BCO 2022

between staff, reduces levels of concentration,[25, 27] lowers levels of motivation,[25] reduces confidential discussions[25, 27] and reduces environmental satisfaction.[22, 26]

Many of the studies in Table 1 found only a weak relationship between density and occupant responses. However, of the 23 studies listed, 19 were carried out in offices and reported on 30 different responses (dependent variables). The majority of these studies showed some negative effects of density on environmental satisfaction, cognitive workload, privacy, communication, concentration, comfort, noise, motivation/commitment, job satisfaction and autonomy. There is, therefore, sufficient evidence to indicate that, in general, an over-dense office will have a negative effect on those present. However, the tipping point for density is more difficult to determine. In their review, Duval et al.[10] conclude that:

> *Overall, the findings from our review suggest that higher-density offices can be detrimental to occupants' environmental satisfaction. However, there was not enough empirical evidence to determine density points above and below which occupant satisfaction is unacceptable.*

In the following sections, we share our own more recent research that helps us understand the appropriate office density levels.

In 2021, Licina and Yildirim[21] investigated perceived noise in WELL-certified buildings of varying density. The highest dissatisfaction with noise was recorded in the building that had the highest density (9.1 m² per person). However, they also found that moving to a WELL-certified building of a similar density (8.7 m² per person) reduced the percentage dissatisfied with noise. So, it seems that other design elements mitigated the issues with noise.

Indeed, the reliability of the effect of density on occupant reactions appears to be confounded by many factors. Duval et al.[10] note that such factors may be physical, such as the degree of enclosure, visual and acoustic privacy, opportunities to control the environment, or other differences between pre- and post-move buildings. On completion of their 2015 study of agile-working environments, Keeling et al.[36] concluded that:

> *The experience of the spatial environment and its effect on occupant relations cannot be understood using simple metrics of units per given area … To fully understand a person's experience of a spatially constrained office it is necessary to understand the configuration of an office and what it enables them to do.*

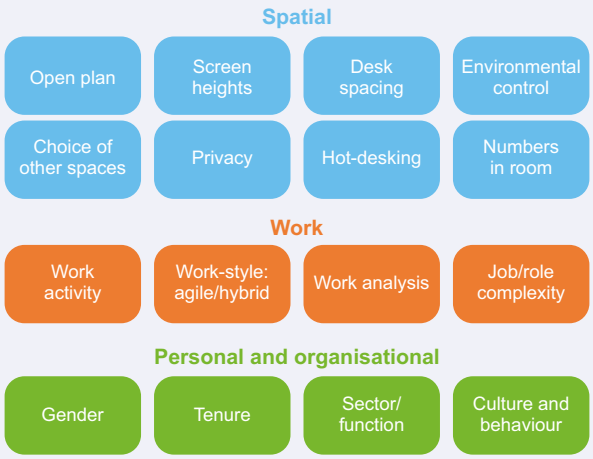


Figure 4
Factors affecting the impact of density on occupants

We also believe that the way in which density is measured (whether social or spatial density), the degree of enclosure (particularly open plan and screens/partitions) and the office design and desk layout all influence the effect of density.

Duval et al.[10] also suggest that confounding factors in density studies may be more personal ones, such as job role and complexity (with those in lower-level jobs being less affected), gender and tenure. Likewise, Fried et al.[19] surveyed university office workers and found the strongest negative relations between density and reactions, such as organisational commitment and job satisfaction, when job complexity and tenure (time in the organisation) were both high. These findings suggest that the effects of office density on occupants cannot be fully understood unless additional organisational variables are accounted for. Based on our research, we also believe that factors such as workstyles and work patterns (including agile and activity-based working) and organisational factors (such as tenure, role, job complexity, culture and normal office behaviours) also affect the response to office density (Figure 4). ■

© BCO 2022

IMPACT OF DENSITY ON OFFICE OCCUPANTS

LEESMAN ANALYSIS

RELATIONSHIP BETWEEN DENSITY AND OCCUPANT EXPERIENCE

The Leesman survey[3] was designed to enable occupiers to understand how the spaces that employees use impact their ability to do their work, and what the key drivers are for employee experience. The survey helps identify the important activities associated with respondents' roles, and how well the workplace supports those activities. Furthermore, it highlights which physical and service features are most important to employee experience, and how well the workplace supports a sense of productivity, pride and enjoyment.

The Leesman analysis carried out as part of this research was mainly focused on three areas, these being the relationship between office density and

- Leesman (Lmi) scores‡
- the workplace activity 'individual focused work, desk based'
- three impact statements:
  - 'It enables me to work productively'
  - 'It creates an enjoyable environment to work in'
  - 'It's a place I am proud to bring visitors to'.

Our initial analysis of the high-performing Leesman+ buildings found no correlation between density (m² per desk) and Lmi scores, workplace activities and impact statements. However, when the densities were grouped (<10, 10–15 and >15 m² per desk) a weak relationship was found between density and the impact statement 'It's a place I am proud to bring visitors to' (Figure 5). The grouped buildings with the lowest densities (more square metres per desk) display the highest scores, varying by 11% (from 76% to 87%).

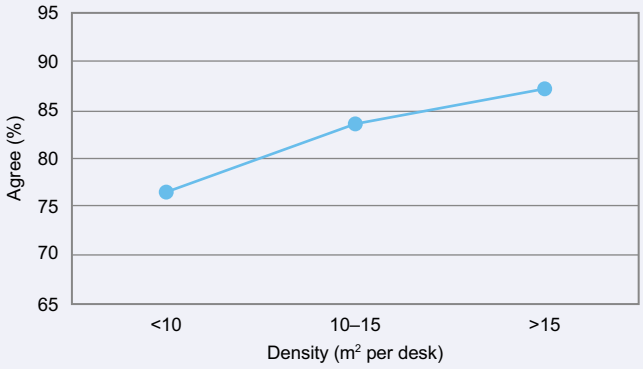


Figure 5
Relationship between density and the impact statement 'It's a place I am proud to bring visitors to'

WORKPLACE ACTIVITIES AND FEATURES AFFECTING OFFICE DENSITY

Leesman's 2018 statistical analysis revealed a series of distinct patterns.§ These patterns uncover a core group of critical work activities and workplace features that determine employee workplace-experience outcomes. These components are the key foundations and drivers of outstanding employee experience. There are four worker activities and six workplace features that statistically contribute most consistently to overall satisfaction.

Work activities:
- individual work, desk based
- learning from others
- relaxing/taking a break
- thinking/creative thinking.

Workspace features:
- noise levels
- accessibility of colleagues
- general décor
- desk
- general tidiness
- small meeting rooms.

Clearly, some of the activities and features will have more onerous spatial requirements, for example better provision of breakout areas (to facilitate 'learning from others' and 'relaxing/taking a break') and small meeting rooms. Noise levels are statistically linked to 'individual focused work, desk based' and 'thinking/creative thinking'. If noise levels are allowed to escalate, they will adversely affect working activities. Furthermore, Leesman found a statistical link with noise levels and the perception of how 'my workplace enables me to work productively'. Controlling noise levels may also be related to space density and layout.

The desk is an important workplace feature that should be considered when thinking about density and layout. Analysis of aggregated data from Leesman+ buildings reveals a weak linear correlation between density and satisfaction with the desk. Conversely, it is pertinent to think about working activities that could be adversely affected by decreasing density. For example, Leesman research shows that 'learning from others' is statistically linked to 'accessibility of colleagues'. Therefore, if density levels fall so low as to impact this accessibility, the risk is that knowledge transfer between employees could be restricted.

As part of the current research, Leesman also investigated if respondents had indicated any changes in requirements of the workspace before the COVID-19 pandemic compared with their most recent data. To do this, Leesman compared responses to the workplace activities and workplace features from 2019 (235,644 respondents) and Leesman's Q3/2021 to Q2/2022 survey datasets (69,947 respondents). The data indicates that there have been noticeable changes in the importance ratings of many work activities and workplace features. This suggests a likelihood that corporate workplaces will be used differently in the future.

The data shows that the work activities 'video conferences' and 'informal social interaction' changed in importance by the greatest extent. The pre-covid (2019) data showed that 'video conferences' was deemed important by approximately 40% of respondents, whereas in Q3/2021 to Q2/2022 approximately 53% indicated that this activity is important, equivalent to a 13% increase. Similarly, some 40% of respondents indicated that 'informal social interaction' was important in 2019, whereas 52% considered it important in Q3/2021 to Q2/2022, a 12% increase.

‡ The Lmi is calculated from two out of the five areas of analysis in the Leesman Index analysis, namely Workplace Impact and Work Activities. A score is then reported on a simple 0–100 scale.

§ Analysis of 401,362 respondents, from 3,000 workplaces across 90 countries. The study mapped the complex web of factors that impact, shape and ultimately determine employee sentiment, isolating and identifying the elements that carry greater weight in driving their daily workplace experience.

© BCO 2022

LONGITUDINAL ANALYSIS

In this section we present evidence on the effects of increased density obtained from longitudinal research of seven office buildings, split into individual tenancies and floors where relevant, each studied between two and three times between 1995 and 2016, using identical methods of data collection and analysis (for more details of the surveyed buildings, see Bunn[37] and Bunn and Marjanovic-Halburd[38]). Repeated use of the same occupant survey captured categorical information on the occupying organisations in terms of staff age profile, gender, working hours, work tasks and workgroup sizes. The survey used was the Building Use Studies (BUS) self-completion survey managed by engineering consultant, Arup. BUS primarily covers satisfaction with thermal, lighting, noise and other comfort variables, along with some functional variables such as satisfaction with meeting rooms and personal storage.

A question on perceived density was developed for the most recent longitudinal office surveys to enable comparison with other environmental variables, as well as comparison with measured population and desk densities. Figures 6–8 show how office users' perceived density (i.e. whether a space has too few or too many people) compares with the actual measured density. When perceived and actual density are plotted and found to be broadly consistent, it is possible to overlay a third variable, such as self-reported perceptions of noise, health or productivity, to determine whether those factors have any relationship to both actual density and occupant perceived

Figure 6
Noise overall and perceived desk density versus actual density

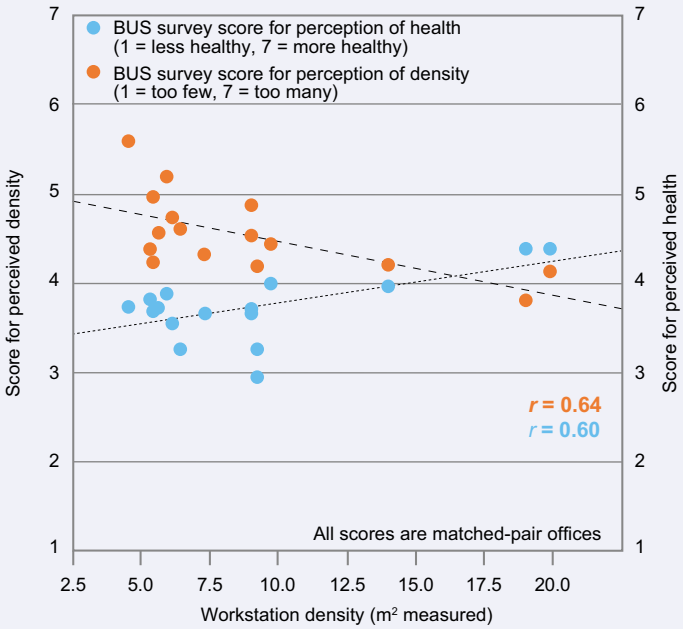


Figure 7
Perceived health and perceived desk density versus actual density

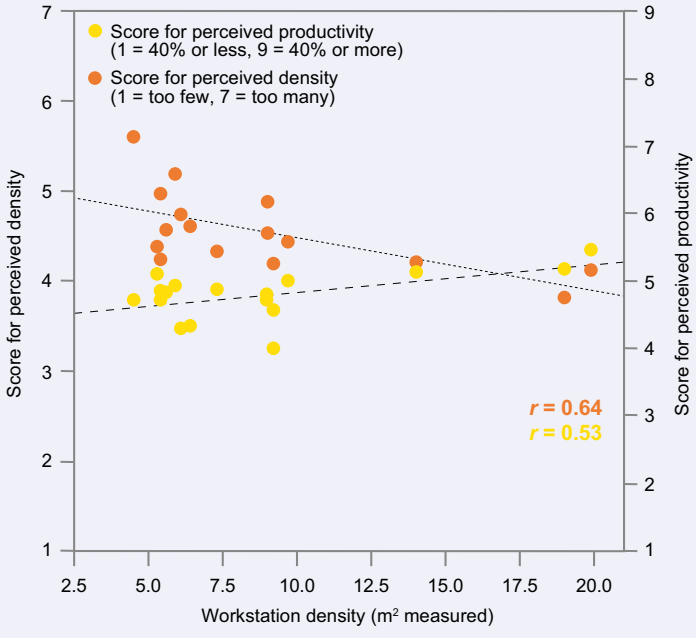


Figure 8
Productivity and perceived desk density versus actual density

© BCO 2022

density. In the figures, the best-fit regression lines indicate the slope of the data points in relation to actual density. By reversing the perceived noise, productivity or health scales in relation to the perceived density scale, a crossover point can be identified on the best-fit trend lines.

Figure 6 shows the mean scores for occupants' responses for 'noise overall' against their perceived density scores and against actual measured density. Data points are paired for complete buildings, tenancies and specific work zones, with no repeated data. Densely-occupied spaces tend towards environments that are perceived as noisy.

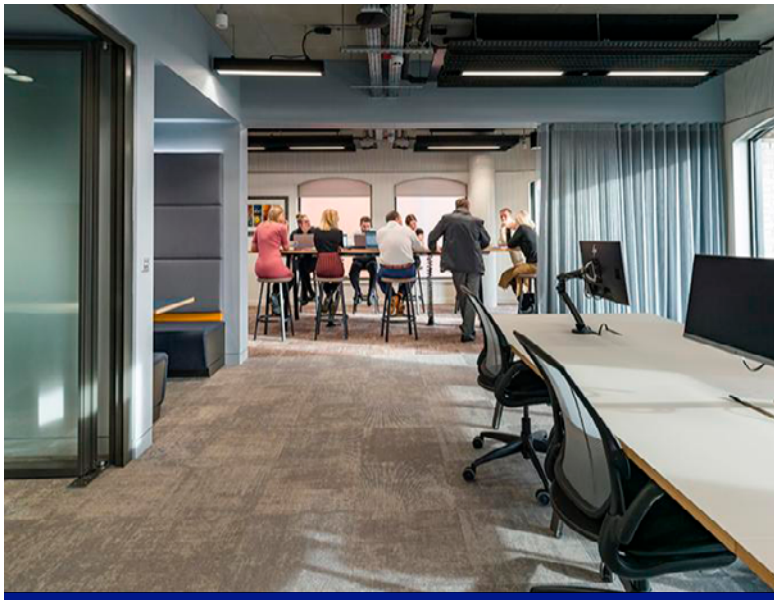
Figure 7 shows the mean scores for occupants' responses for 'perceived health' against their perceived density scores and against actual measured density. High-density spaces tend towards environments that are perceived as unhealthy.

Figure 8 shows the mean scores for occupants' responses for 'perceived productivity' (scale 1–9) against their perceived density scores and against actual measured density. Note that in this figure the 9-point scale used in the BUS for perceived productivity has the effect of suppressing the trend line.††

The crossover points in Figures 6–8 may be evidence of the beginning of a negative relationship; that is, when actual density increases and the space falls below 8 m² per person, satisfaction with noise, health or productivity may begin to degrade. This is reinforced by respondents scoring their workplace as erring towards having too many people. However, the three charts do not provide definitive evidence because of the small dataset and the paucity of data points for offices occupied at a density of more than 15 m² per person. That said, each datapoint is rich in detail, with high survey response rates for each office area or complete building. The depth of detail enables the data points to be validated. On that basis the charts in Figures 6–8 demonstrate that offices providing below 8 m² per person of office space are likely to generate poor occupant survey scores for a number of density-relevant variables.

Detailed interrogation of the longitudinal dataset indicates that density-related discomfort tends to involve the following hygiene and comfort factors. The degree of discomfort will be different for different buildings and will depend on office functions and the (often highly variable) quality of facilities management.

- *Hygiene factors*. Hygiene factors are primarily toilet provision informed by standards and industry-accepted metrics. Stresses occur with sheer numbers, with knock-on pressure on cleanliness (actual and perceived), availability (at critical times) and maintenance (itself a consequence of higher use beyond the design provision). Dissatisfaction with toilets is usually a reliable 'canary in the coal mine' for other density-related issues that may be close to their tolerance thresholds.
- *Storage factors*. Dissatisfaction with local storage is often an early result of densification. Numerical values obtained during site measurements are the distance and time taken to and from dedicated storage. Lower desk density and local storage is less space efficient than centralised storage, but central storage is less work efficient and convenient, and places a greater efficiency demand on workers when obtaining and managing work materials (and this is potentially exacerbated by clear-desk policies).



Riverside House, New Bailey, Irwell Street, Salford
Copyright Muse Developments

- *Reverberation and sound levels*. Over-densification leads to problems with peak sound pressure levels (location and time specific), self-reported worker concentration and lack of acoustic privacy. Depending on the individual context, discomfort thresholds occur at both high and low densities – places can be too quiet as much as they can be too noisy. High-density spaces are rarely too quiet. Relevant noise from colleagues is less of a problem than irrelevant noise from others (and other workgroups).
- *Lighting and daylighting*. These variables are independent of density, but nonetheless can be problematic where there is lack of local control and opportunities to adapt the subvariables of illumination levels (lux), glare index (electric and natural), daylight asymmetry and daylight glare control. The higher the density, the more fixed each worker (with fewer workstation adaptations available), and therefore the more that occupiers may be forced to work in suboptimal lighting conditions. Window seats may provide stress-relieving environmental control opportunities in densely occupied offices, but in deep-plan and high-density offices the majority of occupants will not benefit. Dissatisfaction levels can sometimes show statistically by comparing subsamples of occupants in window and non-window seats.
- *Workgroup identity*. Identity may be lost with increased densities. Office workers need a degree of personal space and acoustic and visual privacy, commensurate with the nature of their work. This is also true of teams of people working together. Evidence from the longitudinal studies showed that boundaries between workgroups became blurred and individual workgroups were subsumed as densities increased. Forced proximity with workers outside workers' sphere of collaboration could be perceived as a negative outcome. This may motivate escape behaviours and a tendency to collaborate elsewhere, given the opportunity.

†† The use of the 9-point scale in BUS came about from a desire from BUS users in the 1990s for a +40%/–40% range in perceived productivity scores in 10% increments either side of a neutral scale midpoint.

© BCO 2022

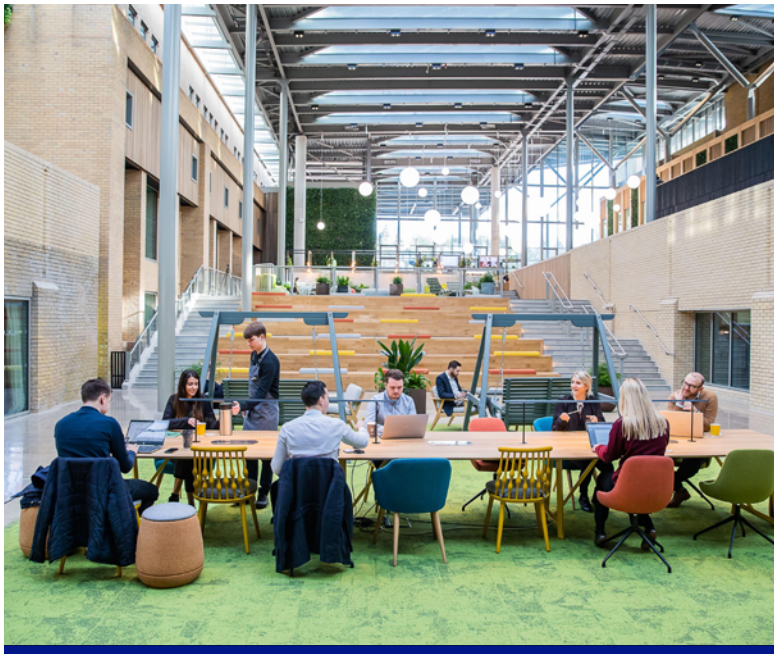
The worst-performing office areas with density-related problems combined the following elements:

- high-density permanent workstations (≤7 m² per person for desk area)
- under-provision of toilets (exacerbated by unisex toilet provision leading to high dissatisfaction or anxiety among female workers), accentuated by more downtime for additional maintenance during the working day
- limited personal storage and personal space, and/or storage located at distance
- few personal escape opportunities to better work areas, magnified by dictatorial and/or ineffective facilities management
- the challenge for open-plan control is to ensure that the control zones are appropriate and can be, or are, reconfigured as space is reconfigured over time; it is also vital that the building control management system is responsive to occupant needs
- setpoints for heating and cooling that do not take into account the office gender balance (at least consider the ratio of males to females before deciding on set-point temperatures)
- high reverberation times (>1 s) at particular locations and at times of low density (i.e. lack of acoustic soundproofing) and high speech intelligibility at times of low density (i.e. poor acoustic privacy).

Note that buildings operating at a high population density (≤7 m² per person) but with many compensatory components (escape opportunities, agile working, caring and diligent facilities management) might stay on the right side of acceptable performance. However, as the incipient risks will exist in the background, the chances of underperformance will be high if standards are allowed to slip.

BCO MEMBERS SURVEY

In our online survey, BCO members were asked to estimate their current office density, based on the space per desk across a typical working floor, and to rate their satisfaction with the density of their immediate desk area, their floor and their building (on a scale from 1 = very unsatisfied to 5 = very satisfied). A total of 170 respondents answered both sets of questions, and statistically significant, albeit weak, relationships were found between the estimated density and satisfaction with desk area (r = 0.27) and satisfaction with working floor (r = 0.22). The correlation was improved by averaging the satisfaction scores for each 1 m² of density. For example, Figure 9 shows the moderately strong (r = 0.37) relationship between estimated floor density and satisfaction with floor density.



Glasshouse, Alderley Park, Macclesfield
Copyright Bruntwood SciTech

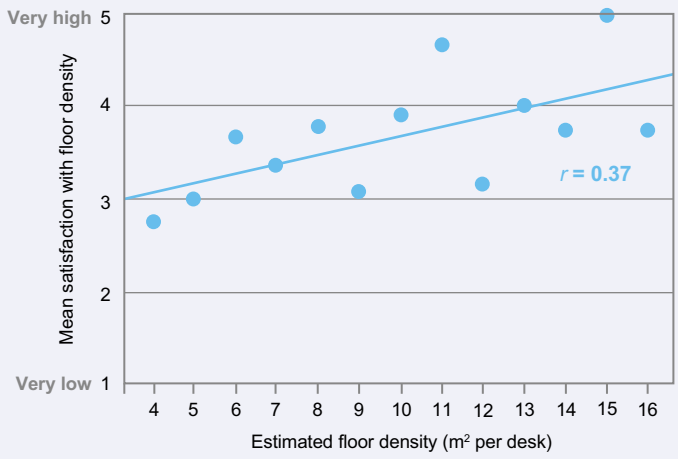


Figure 9
Correlation between satisfaction with floor density and estimated floor density (BCO members survey)

© BCO 2022

IMPLICATIONS FOR THE BCO GUIDES

Our research has identified the following points regarding impact of office density on office occupants that are particularly relevant to the BCO guidance.

- There have been relatively few studies specifically exploring the impact of occupational density, and more of these have reported differences between open-plan and private offices rather than density *per se*. Many studies have associated open-plan design with higher density, but open-plan design should not be confused with office density.
- Most of the research that has specifically looked at the impact of density on occupants shows that high-density environments can affect comfort, wellbeing and performance. However, the relationship is weaker than may be expected in many of the studies carried out in real offices, rather than simulations, due to confounding factors that operate in real environments.
- The legacy desktop research and our own research indicates that higher workstation area densities (less than 8 m² per person) are more likely to cause issues and affect occupant comfort, wellbeing and performance for most organisations. Such high densities may lead to functionality and comfort problems, including noise from colleagues.
- In contrast, the research generally shows that workstation area densities of 8–12 m² per person are acceptable and will not necessarily give rise to serious problems. Nonetheless, incipient or sporadic problems with functional variables, such as toilet provision, may occur at the lower end of the scale, and almost certainly at regular workstation densities below 8 m² per person.
- In offices with lower densities (more than 12 m² per person), most workspace issues and concerns are alleviated. There is absence of discomfort and dissatisfaction with most comfort and functionality variables, assuming all other workplace needs are met.
- It is important to note that the 'per person' density metric refers to the number of people present in the building. In traditional offices with 1:1 desking, 'per person' does correspond to 'per desk', but in more agile environments there is likely to be a mix of desks and other work settings accommodating the occupants. The implication for the BCO guidance is discussed later in this report.
- The effect of density is confounded by physical factors such as the features and typologies, including the distance between desks, the height of desk screens, the size of open space (the number of people in one space), the layout of desks, the level of partitioning between clusters of desks, and access to private workspace. It is also affected by organisational factors such as culture, tenure, gender and job complexity. Work-related factors, such as work patterns, work activities and agile working, also determine the effects of density on people. ■

© BCO 2022

CHANGING WORK PATTERNS AND OCCUPANCY LEVELS

The interviewees in this study suggested a range of occupancy levels, with an average pre-pandemic estimate of 70% ± 10% and a likely future occupancy of approximately 45% ± 10%. However, our survey respondents were more conservative, giving higher estimated occupancy. They recalled pre-lockdown occupancy levels of 81% ± 16%, 55% ± 21% during lockdown and a future planned or anticipated occupancy level of 68% ± 18%. The most popular estimates of anticipated occupancy levels were 50%, 60%, 75% and 80%. Not only are these figures higher than expected, but such a range makes it difficult to pinpoint optimal future occupancy levels.

Several organisations share data on the occupancy levels (utilisation) of offices. Remit Consulting currently has 13 companies contributing to its ReTurn dataset,[39] which comprises 155 office buildings in ten major UK cities, covering approximately 200,000 workers. Figure 10 shows how the average national occupancy levels have increased since the January 2022 outbreak of the Omicron subvariant of COVID-19. It also shows the mid-week peak, with occupancy levels reaching 33%; this is equivalent to the lower end of the current occupancy levels estimated by our survey respondents. If our respondents' estimates of future occupancy levels are correct, then Remit's 33% peak is likely to reach around 46%, or approximately 50%.

The range in estimates of occupancy levels may be due to organisational factors, such as sector. However, while we found statistically significant differences in the estimated current level of occupancy, with the occupancy in public sector organisations being lower than others, we did not find any differences in anticipated occupancy levels. We also did not find any statistically significant differences according to role, city/town location or geographical area.

Variations in occupancy levels across the working week makes it more difficult for respondents to estimate their overall, or average, occupancy levels. For example, interviewees recognised that offices will be busier on Tuesday, Wednesday and Thursday, and that such peaks will need to be managed. They also commented that those organisations that are new to hybrid working are more likely to struggle with peaks than those that had already implemented agile working before the COVID-19 lockdown and had already worked on balancing out occupancy levels across the week.

Likewise, the results of our survey also revealed anticipated mid-week peaks among the respondents. Figure 11 shows that around two-thirds (62–66%) of those interviewed anticipate occupancy levels will rise to 60% or more on Tuesday, Wednesday and Thursday, and almost one-third (28–29%) expect mid-week occupancy levels to reach 80% or more. The mid-week peaks vary from the weekly average occupancy level. This presents a challenge for building operators when planning for their occupancy levels. In general, greater variations and uncertainties in utilisation create a higher management burden compared with the certainties that accompany high and predictable utilisation.

Our analysis of the full worldwide Leesman dataset provides an insight into the number of days offices will be occupied. Based on 27,611 responses received in Q3/2021 to Q2/2022, it appears that, contrary to other surveys, a high proportion of office workers do not intend to work in the office on a weekly

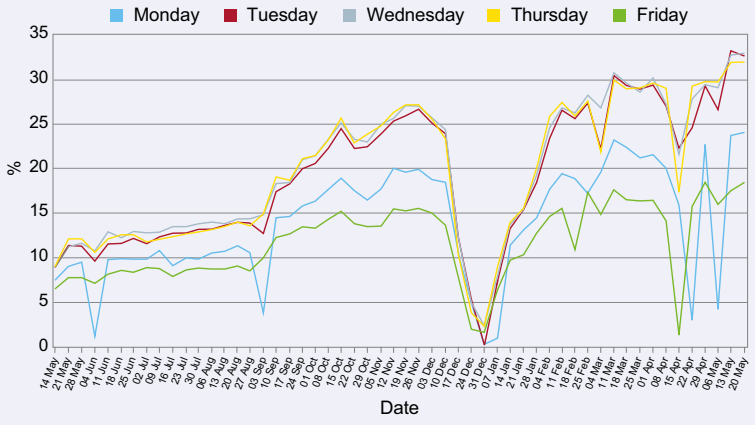


Figure 10
Average UK office occupancy levels, May 2021 to May 2022
Copyright Remit Consulting[39]

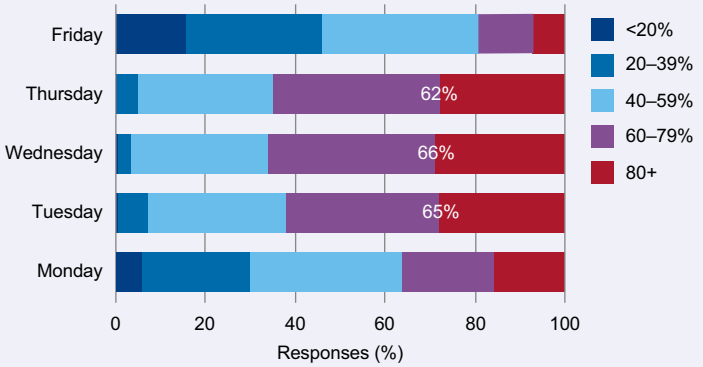


Figure 11
The percentage of occupants anticipated to be in the office on each weekday (BCO members survey)

© BCO 2022

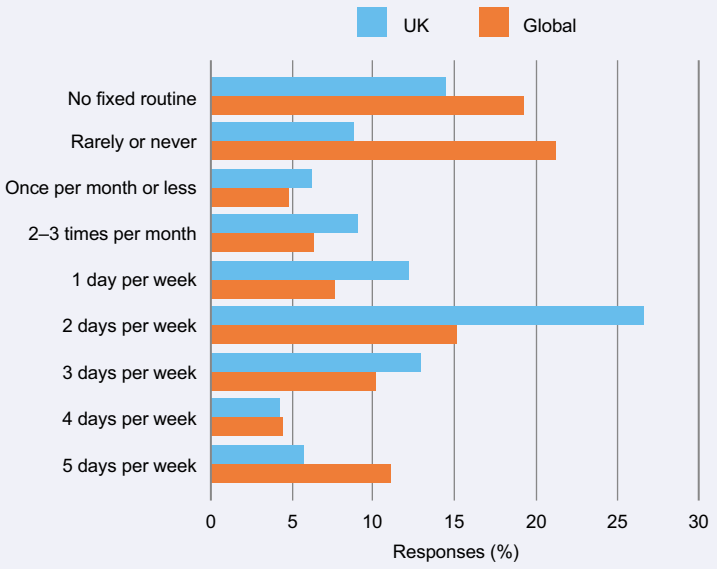


Figure 12
The number of days workers plan to be in the office
(Leesman dataset Q3/2021 to Q2/2022: 27,611 global participants, 3,569 UK participants)

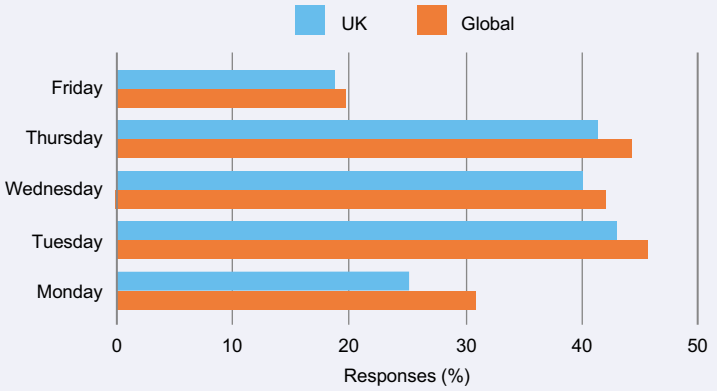


Figure 13
The weekdays that workers plan to be in the office
(Leesman dataset Q3/2021 to Q2/2022: 27,611 global participants, 3,569 UK participants)

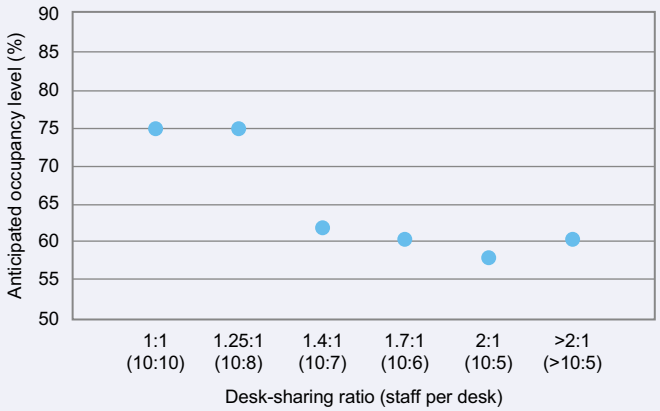


Figure 14
Mean anticipated occupancy level by planned desk-sharing ratio
(BCO members survey)

basis, with over 40% of global workers planning not to be in the office on a weekly basis. Almost two-thirds (62%) are planning to be in weekly, and of these 2 days per week is the most popular number of visits, with only 23% of respondents planning to be in the office for more than 2 days (Figure 12). When visiting the office, Tuesdays, Wednesdays and Thursdays are most popular (Figure 13).

Our survey of BCO members revealed that the anticipated occupancy levels correlated fairly well with the planned level of desk sharing ($r = -0.35$). Figure 14 shows that those planning to continue with traditional working (1:1 desking) or conservative desk sharing (10:8 people per desk) estimated significantly higher future occupancy levels (average 75%) than those implementing hot-desking at higher sharing ratios (average approximately 60%). The respondents are acknowledging that if hot-desking is introduced then the number of occupants present in relation to the headcount assigned to the building will also reduce. However, this appears counterintuitive to agile-working environments, where hot-desking is often introduced to increase the utilisation of the desks. One agile-working strategy is to reduce the number of desks, and associated space, but maintain the number of occupants visiting the space, who hot-desk so that the proportion of the remaining desks that are occupied will increase. Alternatively, the number of desks and space remain the same, but more occupants are assigned to the building, and they hot-desk, thus increasing the desk utilisation. Either way, the occupancy level relative to the number of desks (rather than headcount) will increase, and therefore it is likely that the corresponding workspace density in terms of the space per person present will also increase.

In terms of desk-sharing ratios, only 20% of our survey respondents anticipate continuing with 1:1 assigned (traditional) desking (Figure 15). In contrast, one-half (48%) intend to implement desk-sharing ratios of 10:6 to 10:8 people per desk, and one-fifth (19%) are considering sharing ratios of 2:1 or higher. In its 2022 report entitled *The 'Sticky Workplace'*,[40] Squaredot notes that agility is increasing. Squaredot predicts that the desk-sharing ratio will rise to 10:5, compared with the typical pre-pandemic value of 10:8.

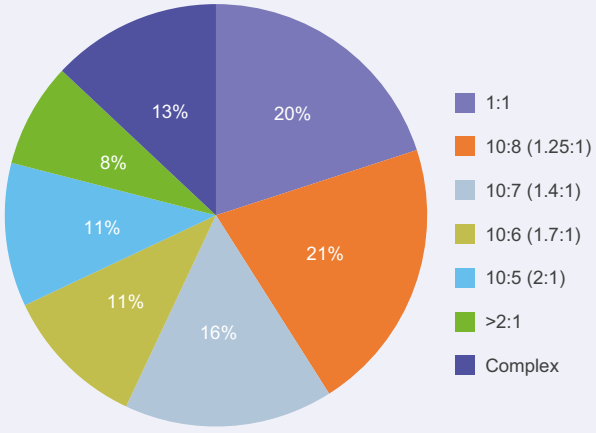


Figure 15
Mean anticipated occupancy level by planned desk-sharing ratio
(BCO members survey)

© BCO 2022

IMPLICATIONS FOR THE BCO GUIDES

Our research has identified the following points regarding changing work patterns and occupancy levels that are particularly relevant to the BCO guidance on workplace planning densities.

- Most of the organisations surveyed reported mid-week peaks in occupancy levels of 70% ± 10%. These will need to be managed so that peaks are levelled out, or alternatively the BCO guidance will need to allow for such peaks.
- Planned occupancy levels vary between sectors. For example, occupancy levels are likely to be lower in public sector organisations, typically 40% ± 10%, but there may be mid-week peaks.
- Workplace strategy and workstyle affect occupancy levels. The range is approximately 70% ± 10% for traditional offices and 50% ± 10% for agile-working environments. The BCO guidance should therefore offer a range of occupancy levels that can be used to calculate effective density (discussed later). However, an indicative occupancy level will need to be agreed for calculating planning densities at the base-build stage.
- Many organisations are exploring agile working, including working from home and hot-desking. Where hot-desking is introduced, the occupancy levels relative to the reduced number of desks (and corresponding reduced space) will increase. Typically, agile organisations aim for 80% utilisation of desks. The BCO guidance needs to acknowledge the planning density consequences of implementing hot-desking. ■

Riverside House, New Bailey, Irwell Street, Salford
Copyright Muse Developments

© BCO 2022

FUTURE OFFICE DENSITIES

PUBLISHED PREDICTIONS

Regarding the BCO's *Guide to Specification* and *Guide to Fit-Out*, a key question is what office density should be used for design and planning post-pandemic. As mentioned previously, the 2019 BCO *Guide to Specification*[1] recommends 10 m² NIA per workspace for typical offices (based on 80% occupancy), which is equivalent to an effective density of 12.5 m² per person. However, other organisations have their own recommendations. For example, Drivers Jonas Deloitte's 2010 *Employment Density Guide*,[41] which is aimed at English Partnerships practitioners, proposes a benchmark density of 12 m² per full-time equivalent (FTE)[‡‡] for general offices and 8 m² per FTE for call centres. Similarly, but much later, the Government Property Agency's 2020 *Government Workplace Design Guide*[42] recommends a planned occupant density of 9 m² per occupant in a new-build fit-out, with the building services based on a density of 8 m² per FTE. It also recommends a lower density for refurbishments of 12 m² for both planned occupant density and FTE density. Other organisations will have their own space standards and planning densities. Interestingly, the analysis of offices in the USA by Keable et al.[43] found a tipping point of 12 ± 0.4 m² per work seat of the usable floor space.

The Hubble Team[44] acknowledges that the amount of office space required depends on an organisation's employees and workplace strategy, but nevertheless comments that 'the most commonly accepted rule in London is that 100 sq. ft. [9.3 m²] per employee is the ideal amount of space per person'. However, it also notes that 'many companies opt for the more cost-efficient ratio of 70–80 ft² [6.5–7.4 m²] per person'. During the pandemic, Knight Frank[45] reported that in London typical office densities in the City were 11.7 m² per person (employee) compared with the Docklands at 9.7 m² per person. It went on to point out that the space per person in the Docklands was 23% below the recommended minimum threshold of 12.5 m² per person required to maintain social distancing.

Several surveys have revealed that, while densities were lowered during lockdown to allow for more space between occupants, they are likely to increase in future. For example, Deloitte's 2020 survey of 100 senior FSI executives[46] found that, while half (54%) of their respondents cited density reduction as a key factor in their return-to-work strategy, most workplaces are not designed so that occupants remain distant from one another. In the same year, JLL[7] proposed that, despite the pandemic accelerating changes in office design and layout and short-term densification, 'once a vaccine or effective treatment is available, there is likely to be a movement back toward the densities recorded pre-COVID-19, but not all the way, as health and well-being will remain top of mind for occupiers'. However, it also noted that 'some organisations will struggle to move toward lower-density occupation and may therefore encourage higher levels of homeworking' or will lease additional space, whereas, in contrast, others may take advantage of lease breaks and release space. Also in 2020, Cushman and Wakefield[47] found that 'little change is happening with building layouts in the short-term beyond accommodating social distancing. However, the expectation in the long-term is for expanded communal space such as conference rooms of various sizes, huddle rooms and social areas for people to congregate'. They also noted, 'in order to implement space reductions, daily occupancies will need to be managed through communication, policies and technologies in a way that most organisations have not done historically'.

BCO MEMBERSHIP RESPONSES

Based on the published information, it appears that, previously, 10 ± 2 m² per *person* was the ballpark recommended planning density, where the 'person' represents the number of people present rather than the assigned headcount. Coincidentally, our interviewees offered a range of 10 ± 2 m² per *desk*, mostly based on 1:1 desking, and acknowledged that densities will reduce if the office is not fully occupied. Our survey respondents indicated that current office densities are 9.0 ± 2.4 m² per desk, and planned densities are slightly increased at 9.4 ± 2.4 m² per desk, based on 113 paired responses. Figure 16 shows the range of estimated densities, with 10 m² and 8 m² per desk followed by 12 m² per desk being the most common. This planned density might be rounded to 10 ± 2 m² per desk to account for the mode values.

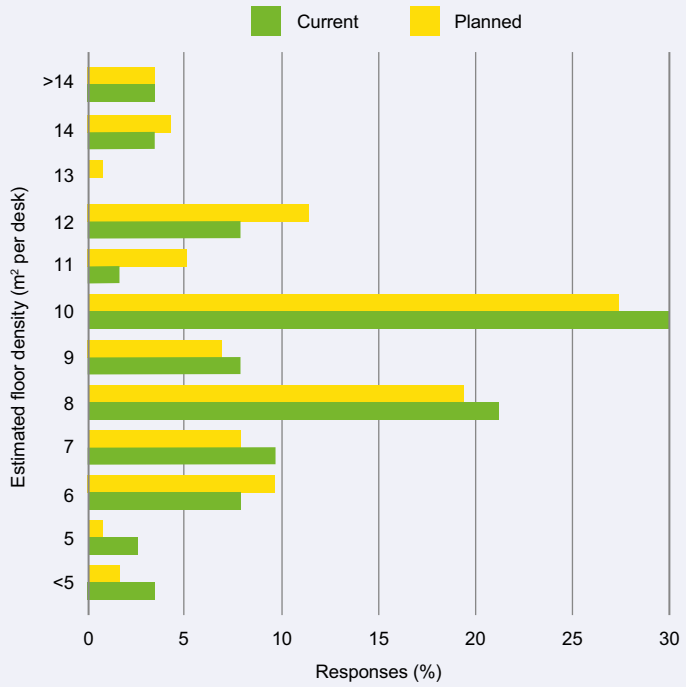


Figure 16
Current and planned future office densities (BCO members survey)

[‡‡] FTE is an employee's agreed hours divided by the hours of a full-time work year, such that an FTE of 1 is full-time. The FTE may be lower due to part-time working during the week, or to interim or seasonal work.

© BCO 2022

Figure 16 shows that there is some movement from the highest densities of <6 m² to 6 m², and from the 8–10 m² offices to 11 m² or more. However, further analysis indicated that only 13% of the respondents' organisations plan to reduce their office density, although 22% may possibly already have reduced it (Figure 17). Unexpectedly, 8% plan to increase their density, but this may be due to lowering it during lockdown, to meet government guidelines, and aiming to bringing it back to pre-pandemic levels.

In a 2022 survey of 125 real estate leaders, Leesman[48] found that 60% said they intend to reduce their office space. Additional analysis of our BCO members survey revealed that just 26% of respondents say their organisations plan to reduce their total office space, with another 18% saying they have already reduced it. If agile working and hot-desking is implemented, then reducing the office space does not necessarily lead to an increase in density. In fact, our survey also found that 29% of respondents intend to reduce the number of desks, and 21% have already made such a reduction. Furthermore, only 8% of our respondents intend to reduce the desk size.

Regarding current and planned office densities, no statistically significant differences were found for the number of floors leased in the building, the time since fit-out or refurbishment, the organisation's sector, whether the building was in an inner city/town or on the outskirts of a city/town, or the area of the country in which the building was located. The finding from our interviews was similar, with interviewees noting that any location differences are likely to be due to the function of the business and its activities rather than the location itself.

Those we interviewed recognised the difference between typical floor densities and the planning densities required for basic business services such as elevators, stairwells, toilets and mechanical ventilation. The interviewees also acknowledge that higher densities, and possible overspecification, have consequences for embodied and operational energy, but nevertheless they required assurance that the building could cope with peak occupancy levels.

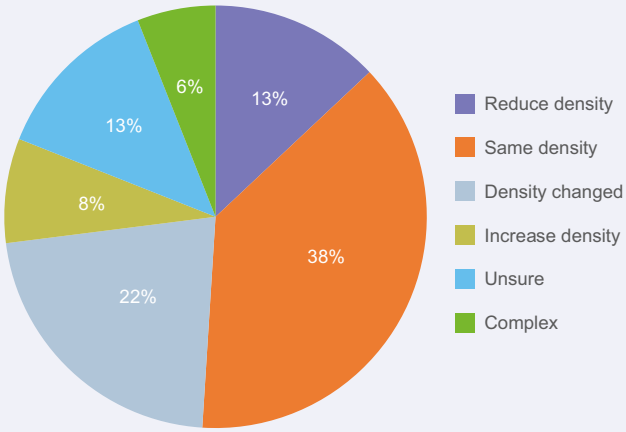


Figure 17
Planned changes to office density (BCO members survey)

IMPLICATIONS FOR THE BCO GUIDES

Our research has identified the following points regarding future office densities that are particularly relevant to the BCO guidance on planning densities for both the base-build and fit-out.

- Buildings are likely to operate at a range of densities, but the literature and our survey indicate that a range of 10–12 m² per person is the most acceptable and a ballpark starting point of 10 m² per desk appears to be reasonable for a typical working floor.
- The starting density will need to be adjusted for the planned occupancy level, which in turn will be affected by the working patterns (days in the office) and workstyles. In particular, agile-working environments with hot-desking are likely to have a higher ratio of occupants to seats than traditional offices with 1:1 desking.
- The effective density is likely to be lower due to lower occupancy levels, but maybe not as low as the proposed revisions to the BCO guidance. Peak occupancy levels of 80% of a typical working floor need to be accommodated or managed to balance out at 60% across the week.
- Occupiers prefer to reduce risks through having sufficient base-build elements (such as toilets, stairwells, elevators and building services). While allowing for higher densities would help mitigate risks, such a strategy may lead to overprovision and overspecification of base-build elements.
- To help mitigate the risk of insufficient base-build elements, a 10 m² per person starting density with a peak occupancy of 80% might be assumed such that the effective density increases to 12.5 m² per person. This is probably acceptable for occasional and short periods of peak (100%) occupancy.
- Other factors will affect space requirements, and in turn the planning density. Such factors include the organisation's activities and the space to support them, and the level of support (non-desk) spaces and amenities provided for the staff.
- The densities referred to above relate to typical working floors. Other floors may be less or more densely occupied. Conference suites and staff restaurants are likely to have large fluctuations in occupancy levels, and therefore in density (m² per person).
- Furthermore, the density per person for the whole-building NIA will be lower (more space per person) than for a typical working floor. For example, if a building has a conference suite and/or staff restaurant taking up 20% of the total NIA, then the density will equate to 12.5 m² per person. ■

© BCO 2022

RELEVANT OFFICE DENSITY METRICS

> "Because people want flexibility and choice, and because organisations will need to cater to a more dynamic use of space, organisations will measure density differently. Historically, density has been associated with headcount per desk. But in a more agile work environment, there is a difference between space per person and space per work point, as occupiers shift the mix of space from predominantly individual to more collaborative and communal."
>
> *Cushman and Wakefield*[47]

The various space studies and guidance reported in the earlier sections of this report use different space metrics. The denominator may be per person, headcount, FTE, desk or work point. Although each metric has its merits, a consistent metric is required. Furthermore, the BCO introduced the concepts of 'effective density' and 'dynamic density', both of which have since been adopted by advocates of different forms of agile working.

We asked our survey respondents to identify their preferred density metric. As shown in Figure 18, half (49%) prefer to use 'per person', and our understanding is that this relates to the number of occupants actually present in the building rather than the number assigned to it (headcount). To prevent confusion, a phrase like 'per occupant' or 'per person present' may be easier to understand. Such a metric makes more sense for the base build and planning of the building services, and estimating the number of desks and support spaces required etc. However, it does require a good forecast of the occupancy levels across the work week, and a mechanism for dealing with peak compared to average occupancy levels. One-quarter (25%) of the respondents favoured 'per desk', which works well in a traditional 1:1 desking office that is fully occupied, which is unlikely for most organisations, or in a workspace where the number of desks is based on the planned occupancy levels rather than the headcount (so, in effect, the same as 'per person').

Some 7% of our respondents preferred the term 'per work point' or 'per work setting'. This term is common among those planning agile-working environments, as it allows for the maximum office capacity – those few times when all 'seats' are occupied. Again, if the work points are not regularly fully utilised, this metric may lead to overspecification of base-build components such as elevators and ducting. Effective and dynamic density are preferred by 9% of our respondents. These metrics are a means of converting the space 'per headcount' to 'per occupant'.

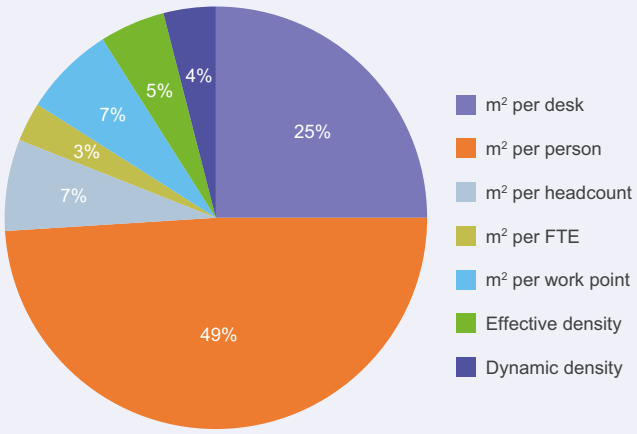


Figure 18
Preferred density metric (BCO members survey)

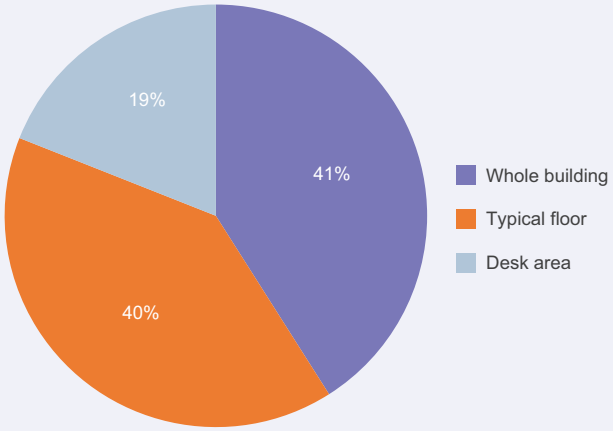


Figure 19
Preferred area of space for the density metric (BCO members survey)

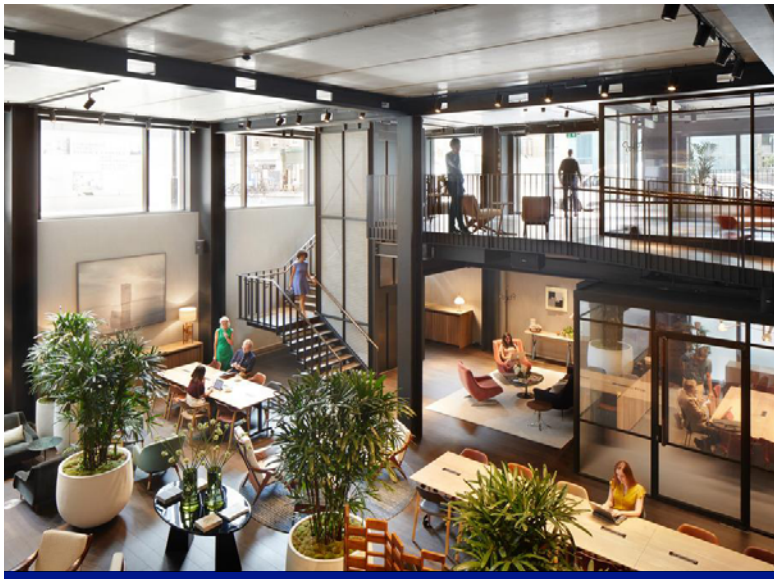
As well as the denominator, the area of space that the density metric refers to also varies. For example, the whole-building NIA is commonly used, but the BCO tends to refer to a 'typical office' or 'working floor' or 'workspace' NIA, as it is more relevant to those leasing floors (part of a building), and they are the more typical floors than those with conference suites, staff restaurants, etc. Assuming the atypical floors are less occupied throughout the day, then using the working floor density for planning adds in contingency. However, it should be noted that this is not always the case; for example, heavily used conference suites (or teaching rooms in higher education) may have higher peak occupancies. Some, particularly researchers, may prefer to use the immediate desk area as their measure. Our respondents are fairly evenly split between using the whole-building NIA and typical-floor NIA (Figure 19).

© BCO 2022

IMPLICATIONS FOR THE BCO GUIDES

Our research has identified the following points regarding office density metrics that are particularly relevant to the BCO guidance.

- The majority of interview and survey respondents prefer to measure density in 'm² per person', which relates to the number of occupants present in the building at any one time, rather than the assigned headcount or number of desks.
- Using 'm² per person' for a typical working floor makes good sense but may lead to over- or under-specification of base-build elements, depending on the intensity of use of the main office floors and other/ancillary floors.
- The 'm² per desk' and occupancy level allow the effective density to be measured, whereas 'm² per person' is more straightforward but does require the anticipated occupancy level to be known.
- Our respondents found using 'm² per occupant' to be clearer than using 'm² per person'. ■



80 Charlotte Street, London
Copyright Make

© BCO 2022

RECOMMENDATIONS FOR THE BCO GUIDANCE

HEADLINE RECOMMENDATIONS

Based on the above research, the following are the headline recommendations for the BCO and its future guidance.

RECOMMENDED DENSITY

- Our findings suggest that, rather than a single density figure, guidance on key factors that impact on space and density is required to enable readers of the BCO guides to determine their own relevant density.
- However, those consulted also like a ballpark (rule of thumb) density figure to use as a starting point, especially at the base-build stage. Buildings are likely to operate at a range of densities, but the ballpark starting point of 10 m² per person for planning the floor layout appears to be reasonable for a typical working floor NIA.
- Furthermore, the research indicates that in offices with lower densities, and more than 12 m² per person on a main office floor, most workspace issues and concerns are alleviated. In contrast, higher office densities, with less than 8 m² per person, are more likely to cause issues and affect occupant comfort, wellbeing and performance in most organisations. The impact of high density may be mitigated, but requires good design investment in the workspace and careful management of it.
- The starting density will need to be adjusted for factors such as the organisation's activities and the space needed to support them, and the level of support (non-desk) spaces and amenities provided for employees. A list of other key factors is required so that a flow chart or decision tree can be used to help illustrate the impact of such factors on density.
- Occupiers prefer a lower risk of not having sufficient base-build elements (such as toilets, stairwells, elevators and building services), and a higher density would help mitigate that risk. However, such a strategy may lead to overprovision and overspecification. Therefore, a similar planning density should be assumed but with higher daily occupancy levels.
- The densities referred to above relate to typical working floors. Other floors may be less densely occupied, and others more densely occupied. Conference suites and staff restaurants are likely to have greater fluctuations in occupancy levels, and therefore greater fluctuations in density (m² per person).

DENSITY METRICS

- The density metric needs to be consistent, but currently several different metrics are referred to in the BCO guides. Our research indicates a preference for 'm² per person', which accounts to some degree for variations in occupancy levels and those who hot-desk. Use of 'effective density' was less popular, and possibly confusing, among our survey respondents, and may not be required if the 'm² per person' metric is used from the start.
- The 'desk' or 'workstation' metric is less relevant today, as more organisations adopt agile and activity-based working with a mix of desks and alternative work settings (such as focus booths and breakout spaces) where occupants may work for part of the day.
- Our survey indicates that measured density is used the least in relation to the immediate desk area, even though it probably better reflects occupant perceptions of various comfort and functional variables. However, equal numbers of respondents are in favour of relating density to a typical working (main office) floor or the whole building. Using a typical working floor, rather than a whole building with conference suites, etc., may build in contingency, or conversely may lead to overspecification. Additional research may be required to determine *typical* occupancy levels for *atypical* office floors.
- Caution is required when comparing the main office floor density with the whole-building density, which is traditionally used by the real estate industry. For example, the required office space can be determined by multiplying the planned occupancy by the density, and then making an allowance for atypical office floors, such as reception, staff restaurant, conference suites and welfare areas. Such spaces may be 20% or more of the total required space, such that 10 m² per person of a typical office floor equates to ≥12 m² per person across the whole building.
- Likewise, there are differences between density figures based on the NIA and those based on the NUA. To allow for the primary circulation, the NUA is typically 80–85% of a typical working floor, so densities based on NIA will appear more generous to those more familiar with those using NUA figures. As NIA includes primary circulation and support spaces as well as desk areas across the floor, it does not capture variations in density. For example, the floor density figure may hide or dilute pockets of high-density desk areas.

OCCUPANCY LEVELS

- The starting density will need to be adjusted for the planned occupancy level, which in turn will be affected by the working patterns (days in the office) and workstyles. In particular, agile-working environments with hot-desking, which are more popular now, are likely to have a higher ratio of occupants to seats than traditional offices with 1:1 desking.
- Our research indicates that a 50% occupancy level could be used to calculate effective density (if this metric continues to be used). However, we suspect that, despite the data, occupiers may consider 50% the average rather than the peak occupancy level. They may wish to build in contingency for higher 80% mid-week peaks or for higher utilisation of desks gained through hot-desking.
- The issue with using occupancy levels to determine the density is how these levels can be accurately predicted for planning and then managed to prevent overpopulation of the building. Perhaps the building infrastructure should allow for 70% ± 10% default occupancy levels.
- To help mitigate the risk of insufficient base-build elements, a 10 m² per person starting density with a peak occupancy of 80% might be assumed. For buildings with higher occupancy levels on the non-desk floors (e.g. footfall due to visitors), an occupancy level of 100–120% or more may be required. Of course, all legislation around base-build elements will need to be adopted.

© BCO 2022

PLANNED DENSITY AND EFFECTIVE DENSITY

The BCO provides guidance on the planning (workplace) density for a main office (typical working) floor 'for on-floor services design, air-conditioning loads, outdoor air allowances and small power loads etc.', and presumably to inform the space planning and layout of the floor to help enhance perceived space and acoustic privacy. The density figures for main office floors are likely to be higher (denser) than the figures for a whole-building NIA, as there may be fewer occupants on the ancillary floors. Therefore, the BCO also provides guidance on the effective density for the core design (base-build) elements such as 'WC provision, lift capacity and to diversify central plant loads', which relates to the whole-building NIA. However, it must be acknowledged that the whole-building density depends on the use and intensity of those non-office floors – on some days, such as when holding events, the building may have more visitors, resulting in less space per person and an increase in density.

Figure 20 illustrates how to determine the planning density and effective density for a main office (typical working) floor. The starting point assigns a ballpark figure of 10 m² per planned occupant for the base build. The number of planned occupants is the maximum number of occupants the floor is designed for. This may be expressed as the headcount or as a proportion of occupants; for example, if hot-desking is implemented, then the desk-sharing ratios may be used to calculate the maximum occupancy. The planned density on a main office floor will depend partly on the size, shape and spacing of the desks, and the level of support space allocated to that floor (e.g. meeting rooms, social space and other work settings), which will vary by organisation. The planned density may also need to be adjusted for other factors, such as corporate culture, industry sector, work activities, job complexity, specialist equipment, proximity to local amenities, legacy space standards (e.g. private offices and desk sizes) and local planning legislation. For example, some functions, such as trading floors and call centres, may require higher floor densities that are supported by facilities located on other floors.

Once the planning density is understood, the effective density can be calculated. The effective density is dependent on the anticipated realistic occupancy levels, rather than the maximum planned occupancy. Our research suggests that, for many organisations, average occupancy levels are unlikely to be as high as they were pre-pandemic. However, factors such as work patterns, including mid-week peaks, and target utilisation levels for hot-desking environments will need to be accounted for. Furthermore, only a small percentage of our survey respondents preferred effective density as a key metric.

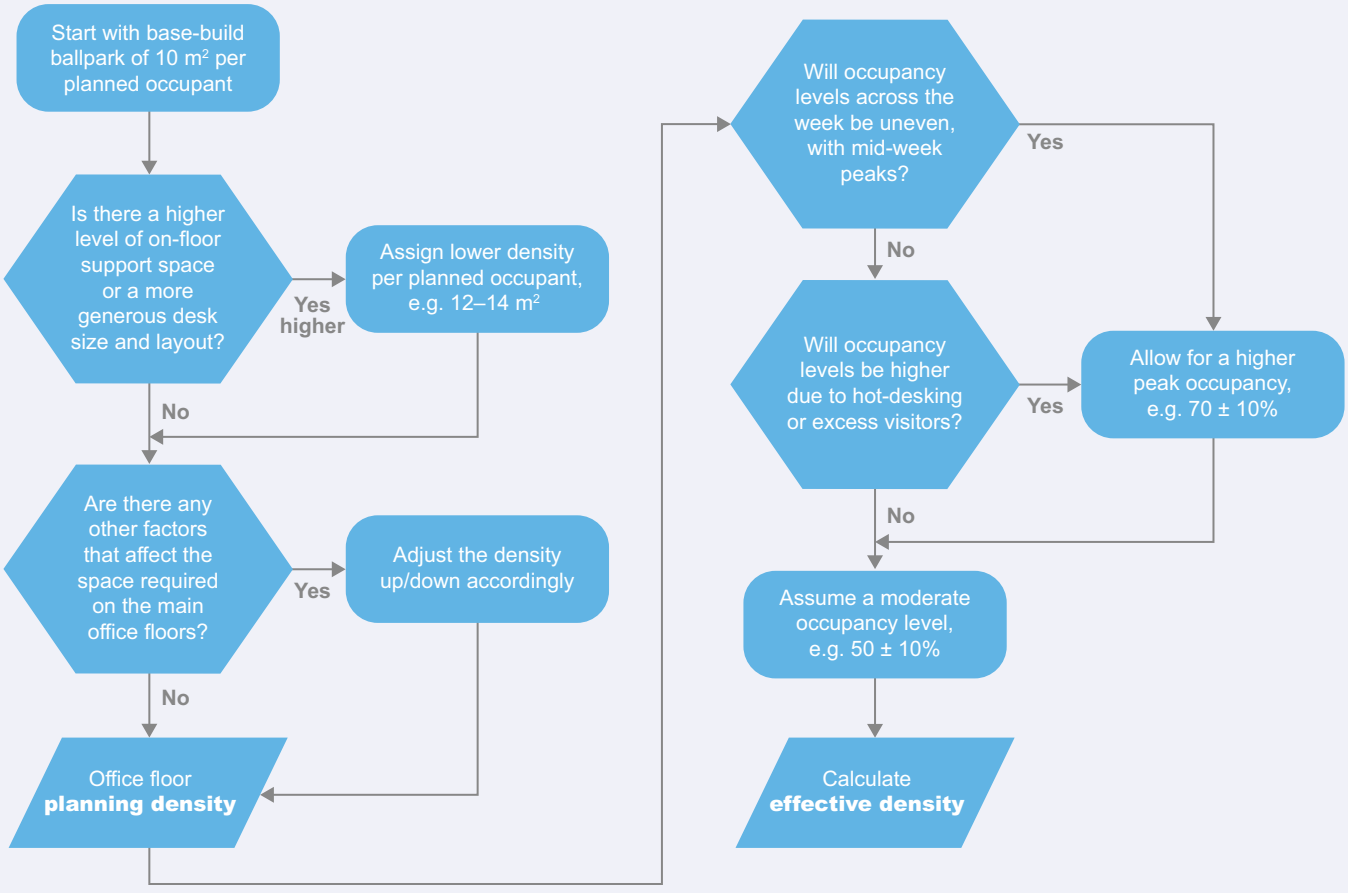


Figure 20
Determining planning density and effective density

© BCO 2022

FINAL THOUGHTS

The following highlights further considerations for the BCO derived from our research.

- *Space reduction*. Our research indicates that real estate portfolio footprints for many organisations will decrease because of the effects of the global pandemic, and their office space requirements will reduce in the future. Such organisations are adopting agile/hybrid working models such that most employees will not have an assigned desk in those offices. Further analysis reveals a strong trend towards offices being designed for increased 'connection'. This, in turn, will likely change the traditional space distribution between desk areas and alternative work settings that support collaboration, connection and socialising. When quoting planned density (m² per person), advisors should quote a single density in m² per occupant that accurately reflects the maximum occupant load across the full NIA, not just particular pockets of space.
- *The rise of multi-tenancy*. With occupiers reducing their required footprints, it follows that those supplying larger developments and office buildings may find themselves under increasing pressure to subdivide floors as space requirements are universally lessened. Design teams should therefore consider the impact on central services and the use of common parts.
- *Impact of density on experience*. The sample of Leesman+ workplaces (i.e. those workplaces that had recorded excellent or outstanding employee workplace experience results) did not reveal any statistically robust relationship between density and employee workplace experience. This indicates that the factors that have the greatest impact on both occupier comfort (acoustics, light, temperature, air quality, sanitary provision, etc.) and the ability of employees to fulfil their tasks (their work activities) have been invested in at such levels as to mitigate the impact of higher density.
- *Utilisation tidemarks*. Many organisations are reluctant to mandate the work days on which employees will use corporate workplaces as opposed to their remote (home) locations. This will create distinctly different high and low values of actual daily occupation (utilisation). Occupiers are increasingly discussing use case scenarios that will place pressure on their offices on particular days, say for quarterly 'all hands' meetings or 'team on-site days'. Whether it is possible within a property strategy to allow for these occasional occurrences is in the hands of occupier clients and their consultants, but if planning for average occupancy levels there is the possibility that there will be days when occupancy levels will exceed the average, potentially decreasing the space per person and increasing pressure on central services. Equally, there will be other days (typically Monday and Friday) when occupiers that are aggressively pursuing a net-zero carbon agenda may want to cordon off whole areas or floors and prohibit their use. In practice, it will be difficult for occupiers to either define or accurately predict typical daily occupancy projections, or know the extent to which they will vary across a working week. ■

Blythswood Square, Glasgow
Copyright Chivas Brothers Limited

© BCO 2022

REFERENCES

1. BCO (2019) *Guide to Specification: Best Practice for Offices*. British Council for Offices. Available at: https://www.bco.org.uk/Research/Publications/BCOGuideToSpec2019Digital.aspx (accessed 25 July 2022).

2. BCO (2011) *Guide to Fit-Out*. Available at: https://www.bco.org.uk/Research/BestPracticeGuides/Guide-to-Fit-Out.aspx (accessed 25 July 2022).

3. Leesman (2022) The Leesman Index. Available at: https://www.leesmanindex.com/benchmark-employee-experience (accessed 25 July 2022).

4. Eve G (2001) *Overcrowded, Underutilised or Just Right? Office Space: How Much is Enough?* Gerald Eve/RICS. Available at: http://www.afec.ie/wp-content/uploads/2016/09/bco_survey_2001-1.pdf (accessed 25 July 2022).

5. BCO (2018) *Office Occupancy: Density and Utilisation*. Available at: https://www.bco.org.uk/Research/Publications/Office_Occupancy_Density_and_Utilisation.aspx (accessed 25 July 2022).

6. Leesman (2022) Leesman+ Certification. Available at: https://www.leesmanindex.com/leesman-certification (accessed 25 July 2022).

7. JLL (2020) *The Future of Global Office Demand*. Jones Lang LaSalle. Available at: https://www.jll.co.uk/en/trends-and-insights/research/future-of-office-demand (accessed 25 July 2022).

8. BCO (2022) *BCO Guide to Specification Key Design Criteria Update 2022: A Position Paper*. Available at: https://www.bco.org.uk/Research/Publications/BCO_Guide_To_Specification_Key_Design_Criteria_Update_2022_-_A_Position_Paper.aspx (accessed 25 July 2022).

9. Oseland NA (2022) *Beyond the Workplace Zoo: Humanising the Office*. Routledge.

10. Duval CL, Charles KE and Veitch JA (2002) *Open-Plan Office Density and Environmental Satisfaction*. IRC Research Report RR-150. National Research Council Canada.

11. DeCroon E, Sluiter J, Kuijer PP and Frings-Dresen M (2005) The effect of office concepts on worker health and performance: a systematic review of the literature. *Ergonomics* **48**(2): 119–134.

12. Davis MC, Leach DJ and Clegg CW (2011) The physical environment of the office: Contemporary and emerging issues. *International Review of Industrial and Organizational Psychology* **26**, 93–237. Available at: https://doi.org/10.1002/9781119992592.ch6 (accessed 25 July 2022).

13. Bharucha-Reid R and Kiyak HA (1982) Environmental effects on affect: density, noise, and personality. *Population and Environment* **5**: 60–72.

14. Block LK and Stokes GS (1989) Performance and satisfaction in private versus nonprivate work settings. *Environment and Behavior* **21**: 277–292.

15. Duvall-Early K and Benedict JO (1992) The relationship between privacy and different components of job satisfaction. *Environment and Behavior* **24**(5): 670–679.

16. Evans GW (1979) Behavioral and physiological consequences of crowding in humans. *Journal of Applied Social Psychology* **9**: 27–46.

17. Hedge A, Burge PS, Robertson AS, Wilson S and Harris-Bass J (1989) Work-related illness in offices: a proposed model of the sick building syndrome. *Environment International* **15**: 143–158.

18. Herbig B, Schneider A and Nowak D (2016) Does office space occupation matter? The role of the number of persons per enclosed office space, psychosocial work characteristics, and environmental satisfaction in the physical and mental health of employees. *Indoor Air* **26**(5): 755–767.

19. Fried Y, Slowik LH, Ben-David HA and Tiegs RB (2001) Exploring the relationship between workspace density and employee attitudinal reactions: an integrative model. *Journal of Occupational and Organizational Psychology* **74**: 359–372.

20. Lange H, Mueller CW and Donnerstein E (1979) The effects of social, spatial, and interference density of performance and mood. *Journal of Social Psychology* **109**: 283–287.

21. Licina D and Yildirim S (2021) Occupant satisfaction with indoor environmental quality, sick building syndrome (SBS) symptoms and self-reported productivity before and after relocation into WELL-certified office buildings. *Building and Environment* **204**: 1–12.

22. May DR, Oldham GR and Rathert C (2005) Employee affective and behavioral reactions to the spatial density of physical work environments. *Human Resource Management* **44**(1): 21–33.

23. Nagar D and Pandey J (1987) Affect and performance on cognitive task as a function of crowding and noise. *Journal of Applied Psychology* **17**(2): 147–157.

24. Oldham GR (1988) Effects of changes in workspace partitions and spatial density on employee reactions: a quasi-experiment. *Journal of Applied Psychology* **73**(2): 253–258.

25. Oldham GR and Brass DJ (1979) Employee reactions to an open-plan office: a naturally occurring quasi-experiment. *Administrative Science Quarterly* **24**(2): 267–284.

 © BCO 2022

26. Oldham GR, Kulik CT and Stepina LP (1991) Physical environments and employee reactions: effects of stimulus-screening skills and job complexity. *Academy of Management Journal* **34**(4): 929–938.

27. Oldham GR and Rotchford NL (1983) Relationships between office characteristics and employee reactions: a study of the physical environment. *Administrative Science Quarterly* **28**(4): 542–556.

28. O'Neill MJ (1994) Work space adjustability, storage, and enclosure as predictors of employee reactions and performance. *Environment and Behavior* **26**(4): 504–526.

29. O'Neill MJ and Carayon P (1993) The relationship between privacy, control, and stress responses in office workers. *Proceedings of the Human Factors and Ergonomics Society 37th Annual Meeting*, pp. 479–483. Human Factors and Ergonomics Society.

30. Rishi P, Sinha SP and Dubey R (2000) A correlational study of workspace characteristics and work satisfaction among Indian bank employees. *Psychologia* **43**: 155–164.

31. Sundstrom E, Burt RE and Kamp D (1980) Privacy at work: architectural correlates of job satisfaction and job performance. *Academy of Management Journal* **23**(1): 101–117.

32. Sundstrom E, Herbert RK and Brown DW (1982) Privacy and communication in an open-plan office: a case study. *Environment and Behavior* **14**(3): 379–392.

33. Sutton RI and Rafaeli A (1987) Characteristics of work stations as potential occupational stressors. *Academy of Management Journal* **30**: 260–276.

34. Szilagyi AD and Holland WE (1980) Changes in social density: relationships with functional interaction and perception of job characteristics, role stress and work satisfaction. *Journal of Applied Psychology* **65**: 28–33.

35. Zahn GL (1992) Face-to-face communication in an office setting: the effects of position, proximity and exposure. *Communication Research* **18**: 737–754.

36. Keeling T, Clements-Croome D and Roesch E (2015) The effect of agile workspace and remote working on experiences of privacy, crowding and satisfaction. *Buildings* **5**: 880–898.

37. Bunn R (2018) *Towards a Theory of Carrying Capacity, Evidence from Long-term Longitudinal Case Studies of Occupant Satisfaction in Non-domestic Buildings*. Doctoral thesis (Eng.D), UCL (University College London). Available at: https://discovery.ucl.ac.uk/id/eprint/10058922 (accessed 25 July 2022).

38. Bunn R and Marjanovic-Halburd L (2017) Comfort signatures: how long-term studies of occupant satisfaction in office buildings reveal on-going performance. *Building Services Engineering Research & Technology* **38**(6): 663–690. Available at: https://doi.org/10.1177/0143624417707668 (accessed 25 July 2022).

39. Remit Consulting (2022) *News Release: Incremental Increase in UK's Office Occupancy Rates*. ReTurn Monthly Report, May. Available at: https://return.remitconsulting.com/resource-centre/27-incremental-increase-in-uk-s-office-occupancy-rates (accessed 25 July 2022).

40. Squaredot (2022) *The 'Sticky Workplace': A New Golden Era for the Office*. Available at: https://www.squaredot.co.uk/the-sticky-workplace (accessed 25 July 2022).

41. Drivers Jonas Deloitte (2010) *Employee Density Guide*, 2nd edn. Homes & Communities Agency. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/378203/employ-den.pdf (accessed 25 July 2022).

42. Government Property Agency (2020) *Government Workplace Design Guide, Part 2: Technical Standards*. Available at: https://www.gov.uk/government/publications/the-government-workplace-design-guide (accessed 25 July 2022).

43. Keable EB, McGregor L and Manley A (2018) How dense is too dense? *Workdesign Magazine*. Available at: https://www.workdesign.com/2018/01/how-dense-is-too-dense (accessed 25 July 2022).

44. Hubble Team (2022) *How Much Office Space Do I Need?* HubbleHQ. Available at: https://hubblehq.com/blog/how-much-office-space-do-i-need#:~:text=Whilst%20keeping%20in%20mind%20the%20ideal%20100%20sq.,Large%20meeting%20room%20%284-8%20people%29%20%E2%80%93%20150%20sq.ft (accessed 25 July 2022).

45. Knight Frank (2020) *Preparing for the New 'Normal': Understanding Employee Densities in London*. Available at: https://www.knightfrank.com/research/article/2020-05-11-preparing-for-the-new-normal-understanding-employee-densities-in-london (accessed 25 July 2022).

46. Buelow SD and Witney T (2020) *COVID-19 Return-to-the-Workplace Strategies: Emerging Lessons and Key Questions for Financial Services Leaders*. Deloitte Insights. Available at: https://www2.deloitte.com/content/dam/insights/us/articles/6763_fsi-covid-recovery/DI_FSI-COVID-recovery.pdf (accessed 25 July 2022).

47. Smith DC, Leinberger C, Katsikakis D, Rodriguez M, Rockey R and Bitner D (2020) *Workplace Ecosystems of the Future*. Cushman and Wakefield, Center for real Estate and Urban Analysis. Available at: https://www.cushmanwakefield.com/en/south-korea/insights/workplace-ecosystems-of-the-future (accessed 25 July 2022).

48. Leesman (2022) *The State of the Estate: Insights from the Top*. Available at: https://www.leesmanindex.com/media/Leesman-CRE-Leaders-Poll-Report-2022.pdf (accessed 25 July 2022).

 © BCO 2022

ABOUT THE AUTHORS

Nigel Oseland BSc(hons) MSc PhD CPsychol

Nigel is an environmental psychologist, workplace strategist, researcher, change manager and author with 11 years' research and 24 years' consulting experience. He is an internationally recognised expert in occupant feedback methods, performance and productivity, agile/hybrid working, environmental conditions and the psychology of workplace. Nigel's approach to workplace consulting is to apply his knowledge, obtained through both academic research and practical experience, to workplace strategy, interior design and change management.

Today, he mostly focuses on his consulting practice, but he also carries out commissioned independent research, for example on behalf of the Atomic Weapons Establishment, British Council for Offices, City of London, Herman Miller, Lendlease, Remark Group, Saint-Gobain Ecophon and Sharp.

Nigel continues to write articles and guidance; his most recent book is *Beyond the Workplace Zoo: Humanising the Office*. He presents regularly at international conferences, co-founded the Workplace Trends conferences, and each year chairs the Workplace Design Conference in Slovenia. In addition, Nigel occasionally lectures at UCL and other universities on wellbeing, post-occupancy evaluation, space management and workplace psychology.

Roderic Bunn BA(hons) EngD

Roderic has a track record in researching the performance of non-domestic buildings, from their energy and carbon dioxide emissions to measuring the comfort and satisfaction of their occupants.

He lectures widely on the role of human behaviour in building performance, and advises building owners and building design teams on ways to ensure that design ambitions can be achieved in reality. He is known for co-authoring *The Soft Landings Framework*, the definitive industry guidance on Soft Landings, and many subsequent supporting guides on Soft Landings. In 2021, Roderic co-developed the Operational Energy and Carbon Framework for the Government Soft Landings process.

Between 1995 and 2001, Roderic led the ground-breaking PROBE building performance evaluation research project. He subsequently worked on the Carbon Trust's Low Carbon Buildings Performance programme (2011), and was a lead evaluator for InnovateUK's Building Performance Evaluation (2011–2015) and Invest in Innovative Refurbishment (2013–2015) programmes.

Roderic co-authored CIBSE guide TM61:2020, *Operational Performance of Buildings*, and authored CIBSE TM62:2020, *Operational Performance: Surveying Occupant Satisfaction*.

He has a Doctorate in Engineering from The Bartlett (UCL), studying occupant satisfaction in non-domestic buildings. This large-scale research project studied long-term occupant comfort in notable UK office buildings and made a case for thresholds of discomfort based on densities.

Roderic is a Silver Medallist of the CIBSE, and a recipient of the 2018 CIBSE Carter Bronze Medal. He currently teaches on UCL built environment MSc courses, specifically leading the MSc module on post-occupancy evaluation.

Tim Oldman BA(hons)

Tim is the founder and CEO of Leesman – the world's foremost authority on employee workplace experience. He started his career in 1991 as a designer in transport design, but by 2003 had developed a greater interest in the business strategy of workplace.

In 2009, while working as an independent advisor supporting several leading global organisations on the alignment of their workplace strategies, he spotted an opportunity to develop a new and unique technique that would properly test the ability of an organisation's places to support its employees. The Leesman Index is now used by industry thought leaders around the world to measure, benchmark and improve the experience of their employees, and sits on the largest database of employee workplace experience, with over 900,000 user responses across more than 6,000 workplaces.

In March 2020, Leesman launched new tools that would also evaluate the experience of employees working from home, and today sits on the largest employee home-working experience benchmark dataset of its kind, positioning Leesman at the epicentre of the future-of-work debate and in a wholly unique position to compare the pre-pandemic workplace with the post-pandemic distributed employee.

Michael Hadcocks BSc

Michael is Senior Researcher at Leesman, and has a solid history in leading research projects within the commercial real estate sector. Michael and the Research Team (led by Dr Peggie Rothe and Dr Madalina Hanc) act as the safeguarders of Leesman's global database, advise on survey methodology, and provide insight and analysis to Leesman's clients and community. Before he joined Leesman, Michael was a Research Manager for a global prop-tech firm, so is well positioned to understand the impact of space use on occupier experience

© BCO 2022

ACKNOWLEDGEMENTS

The research team thank all those who participated in the interviews and workshop.

Mike Ayton (Dowley Turner Real Estate)
Ian Baker (Emcor)
Katy Boulter (Overbury)
Nigel Bunclark (CMA)
Jason Cousins (Lazard)
Clare Danahay (Be Inspired Design)
Rob Harris (Ramidus)
Gary Hills (Coca Cola)
Despina Katsikakis (Cushman & Wakefield)
Kris Krokosz (Square Dot)
Andy McBain (NatWest)
Catherine Murphy (Leesman)
Tim Peake (UK Parliament)
Neil Pennell (Landsec)
William Poole-Wilson (Will & Partners)
Debbie Rogers (Montagu Evans)
Gillian Stewart (Michael Laird Architects)
Andy Trickey (Overbury)
Neil Usher (GoSpace AI)
Robert VanZyl (Cundall)
Peter William (Stanhope)
Bridget Workman (The Changing Work Company)
Nick Wright (Pinsent Masons)
Suzy Wright (BT)

We also pass on our thanks to the 202 BCO members who completed the on-line survey. ■

© BCO 2022

78-79 Leadenhall Street
London EC3A 3DH

info@bco.org.uk
020 7283 0125

www.bco.org.uk

Follow us @BCO_UK or @BCO_NextGen

British Council for Offices – Join the Debate: BCO online or BCO NextGen

facebook.com/British Council for Offices

/British Council for Offices

/British Council for Offices

/BCO_UK

Sign up for our newsletter on www.bco.org.uk

British Council for Offices