DAEDALUS ENVIRONMENTAL

Comet Way
Hatfield

Overheating: Analysis, Mitigation and Recommendations

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1 Introduction

1.1 This Document

1.1.1 This document has been commissioned by Comet Way Hatfield Limited (CWH) to address the council's position regarding overheating risk for the proposed development at Comet Way. A noise assessment undertaken by Cass Allen, which sought to understand the impact of traffic noise on the proposed dwellings has demonstrated that in this location, during the day or night, the ambient noise levels do not meet the council's requirements when windows (and balcony doors) remain open.

1.1.2 To wit, the council, in pre-application correspondence with CWH, have requested that following standards are achieved:

> As standard for impacts due to traffic noise, if opening windows raises the internal noise levels above those within BS8233, then mechanical ventilation providing a ventilation rate as per The Noise Insulation Regulations 1975 will be required. However, if another method or different ventilation rate is to be used, then providing evidence that windows can remain closed during the summer months without overheating through the use of a SAP assessment enables a specific resolution to be found. This can be carried out by substituting the values from Appendix P of the SAP assessment with those expected from the proposed ventilation system with windows closed and no reliance on curtains/blinds.

1.1.3 Whilst CWH understands the issue of potential noise from the road, there are number of key points that need to be made before explaining how the issue has been assessed and associated mitigation measures introduced.

1. The use of SAP as a means to address overheating is fundamentally flawed. SAP is not designed to be an accurate predictor of extent of overheating, rather it gives an extremely high level indication of potential risk.
2. It remains bad practice to address overheating risk through the use of background mechanical ventilation. Mechanical ventilation – with or without heat recovery – is not designed to maintain a specific temperature. Rather, it is designed to provide the necessary level of fresh air into a home or space.
3. As such, increasing the ventilation rate through mechanical ventilation will not only have a generally minimal impact in practice on overheating, it may exacerbate the noise issue from the increase in internal fan size and operating times needed to generate the increase in design air change rate.
4. The above notwithstanding, whilst the basis of the approach of closed windows coupled with mechanical ventilation is understood in terms of giving residents the CHOICE of whether they can close windows if noise levels exceed what they feel to be acceptable during periods of hot weather, in practice the ability to provide fresh air during those periods and rapid purges of air, will most likely be far more preferable that sitting in a sealed space. By providing balcony doors as a feature of the development, such residential behaviour will be

further reinforced – with people encouraged to use these external amenity spaces more during period of hot weather.

1.1.4 Therefore, our argument is that the council must take a far more balanced approach to the issue of overheating and noise, which uses a more appropriate and advanced level of building analysis than SAP. Using dynamic simulation analysis, we can provide a much more detailed insight into the potential risk and impact of overheating, balancing that with a range of design solutions that mitigate the impact. In so doing we can take better account of likely behaviours – and for those very small number of periods where overheating risk is particularly high for specific spaces, allow a scenario where 'windows can be opened' to eliminate risk without long term detrimental impact to future residents.

1.1.5 As a corollary to this, and following a SAP based analysis of high risk property types on Comet Way of the type described in 1.1.2, above, unless a more pragmatic and balanced approach is taken of the type described, that target cannot be achieved.

1.2 Site Description

1.2.1 The proposed development lies on Comet Way (the A1001) in Hatfield. It is a former car showroom and forecourt. The proposed development comprises demolition of existing buildings, and construction of 116 residential apartments, car parking, landscaping including roof gardens, electricity substation and ancillary development.

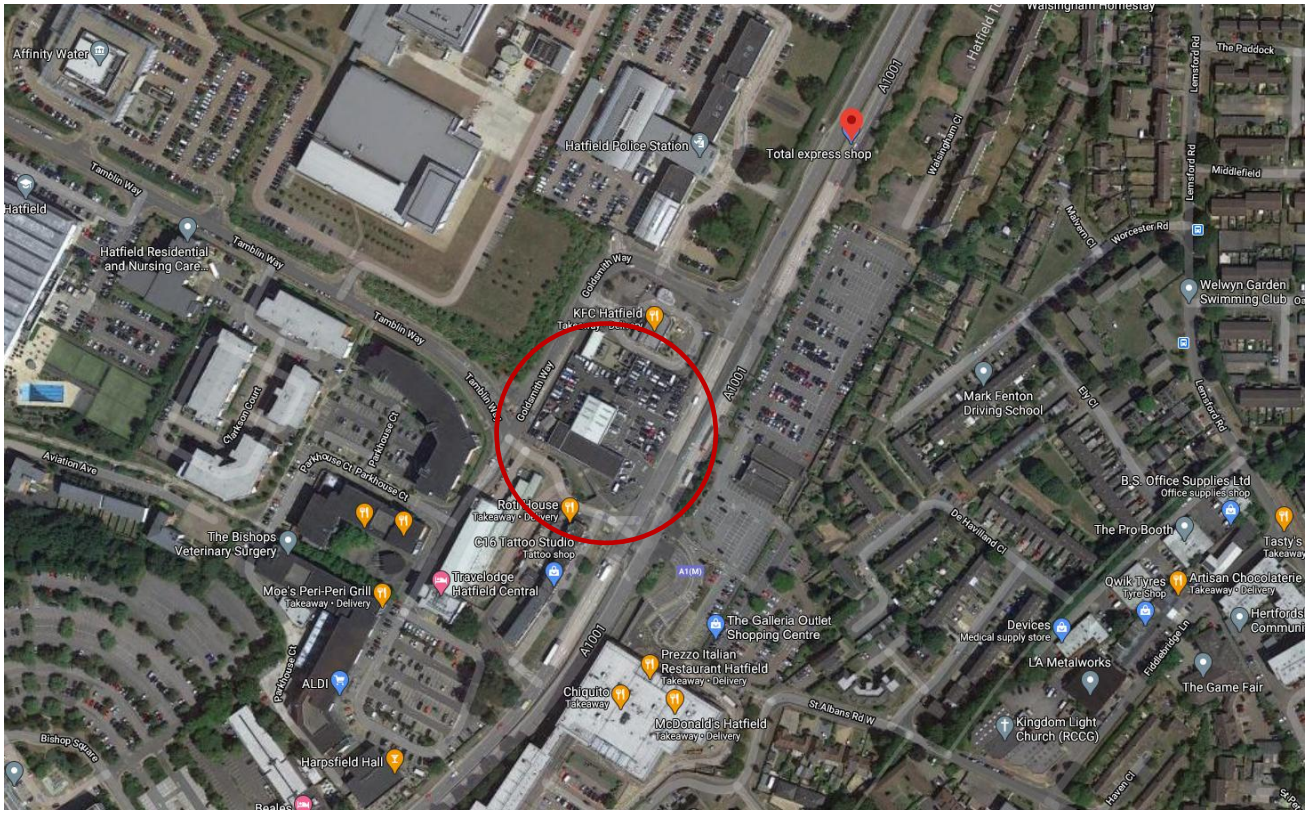

Figure 1: Site location

Figure 2: Proposed development (aerial view from the south)

Figure 3: View of the development at ground floor (from the south west)

2 Understanding Overheating Risk

2.1 Recognised Standards – CIBSE Guides TM52 (2013) and TM59 (2017)

2.1.1 Following growing recognition of the risk of overheating in increasingly energy efficient and air tight structures, combined with the impacts of a changing climate, in 2013 the Chartered Institute of Building Services Engineers published technical manual TM52: Limits of Thermal Comfort Avoiding Overheating in European Buildings (CIBSE, 2013).

2.1.2 TM52 identified 3 criteria against which overheating risk and impact are assessed for new buildings as a whole, whether residential or non-residential, and in order to be compliant with the guidance any given occupied space must pass two of these three, which (drawn verbatim from the Guide) are:

> (1) The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
> (2) The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.
> (3) The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.
>
> *(CIBSE, 2013)*

2.1.3 In 2017, CIBSE then published TM59: Design methodology for the assessment of overheating risk in homes. This refined the analysis and requirements specifically for the residential sector, which further distinguished between homes that are primarily naturally ventilated, and those which are predominantly mechanically ventilated:

Naturally Ventilated	Mechanically Ventilated
Compliance is based on passing *both* of the following two criteria:	Compliance is based on a single criterion:
(a) For living rooms, kitchens and bedrooms: the number of hours during which D*T* is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 percent of occupied hours. (This is CIBSE TM52 Criterion 1: Hours of exceedance, above.)	For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26˚C for more than 3% of the annual occupied annual hours (CIBSE Guide A (2015a)).
(b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).	

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.	

2.1.4 The question therefore arises as to whether the proposed dwellings are predominantly mechanically, or naturally, ventilated. Given the fact these dwellings will have openable windows and balcony doors, indicates the latter. The fact that they will also have mechanical ventilation (potentially with heat recovery), indicates the former. We have assumed, given in practice the ability to open doors and windows (i.e. there won't be physical restrictions on the ability to open windows), that the two requirements for 'predominantly naturally ventilated' will apply.

2.2 Simulation Software

2.2.1 For the purposes of the analysis, we use dynamic simulation software IES <Virtual Environment>, and associated modules, to assess risk and impact of overheating. A model of the proposals is built within the software, from which a range of assumptions and scenarios can then be tested to understand the risk, and impact of any mitigation. An extract of the model is provided below:

Figure 4: IES model extract

2.3 Weather File

2.3.1 In accordance with the requirements of TM59, the weather file employed in the analysis is the DSY1 (design summer year) file most appropriate for the site for the 2020s, high emissions, 50% percentile scenario ('London_GTW_DSY1_2020High50').

2.4 Sampling and Other Limitations

2.4.1 Inevitably, with any such study taking place as part of the design process, there are limitations to results and conclusions that have been drawn. Firstly, in order to complete the assessment, a period of time has been needed to build the model within the software and complete the various sets of analyses that underpin this report, in time for the submission. To do this we have

had to 'draw a line' at a point in time in relation to the building design, which continue to be developed thereafter. Any changes may have some impact on the results provided here.

2.4.2 Moreover, a representative sample (rather than every single unit) has been tested for the purposes of this planning application. Using our experience we have identified a range of properties to give a fully representative sample for the whole development, which includes those dwellings which have the highest risk of overheating – the double aspect corner units which receive sunlight for the majority of the day.

2.4.3 For clarity, all the dwellings which have been assessed:

- Face the road side of the development
- Face either south east, south west (or both)

2.4.4 That is, where there is an overheating risk AND a potential noise issue, along these two elevations:

Figure 5: 'at risk' elevations

2.4.5 Any conclusions drawn within this report therefore must be read in conjunction with these wider limitations.

2.5 Baseline Building Assumptions

U-values (W/m^{2}K)

- Roof – 0.1
- Wall – 0.2 (external and to corridor)

- Party Walls – 0.0
- Glazing (incl. doors) – 1.4 (with a g-value of 0.45 for glass)
- Floor – 0.15

2.5.1 Note the (reduced) g-value for the glazing is a key mitigation measure for dealing with overheating risk. Typically, double glazing has a g-value of 0.65-0.7, reducing this to 0.45 will result in lower solar gain and therefore a reduced overheating risk.

Other Assumptions

- Corridors remain unheated, but heat losses from heat network pipe work is accounted for as per the CIBSE guidance: heating from communal pipework assumed to be 12W/m and from HIUs in flat hallways to be 78W
- Space heating within flats will be provided by centralised gas boilers
- Thermal mass can be characterised as MEDIUM
- That the structure will be built using accredited construction details (ACDs), IG lintels, etc
- Profiles and gains are as per TM59 requirements
- Windows are assumed to be top hung (bedroom and Living/Kitchen/Dining [LKD], 90% openable area, 30deg maximum angle)
- Balcony doors are sliding, 90% openable area
- Lighting gains are as per Section 5.2 of TM59

2.6 Scenarios Tested

2.6.1 Our analysis has encompassed 3 different scenarios to provide a fully informed picture of the potential impact, and what benefits any identified solutions would deliver. Each of the three scenarios include a number of improvements / mitigation measures additional to the baseline specification. The variance between them therefore relates then to how windows are modelled, i.e. whether they are openable and when they are opened. Those mitigation measures are:

- With the lower g-value of 0.45 included
- Ventilation is provided by MVHR (with summer bypass) in each scenario, in line with the requirements of the local planning authority
- The introduction of external blinds or shutters (with usage profiles as described below). The specification of these blinds is predicated on a product such as the Alukon RAFF-E Venetian Facade Blinds, details of which can be found here, and an image of which is provided in Figure 6

Scenario A: windows and balcony doors closed during the day, but with the external blinds down when temperature exceeds 22°C between 8am and 10pm. Windows remain closed at night.
Scenario B: windows and balcony doors closed during the day, but with the external blinds down when temperature exceeds 22°C between 8am and 10pm. Windows to bedrooms can be opened from 22:00-07:00 (i.e. enabling night time natural/purge ventilation)
Scenario C: windows and doors all openable during day and night as desired by the occupant, as a comparator

Figure 6: External blinds (courtesy of Alukon)

3 Results

3.1 Flats Tested

3.1.1 Each of the following flats (specifically the occupied spaces within them) have been analysed as the representative sample – including each bedroom and the living / kitchen / dining room area.

FLAT TESTS
1F flat 05
1F flat 15
2F flat 05
2F flat 07
2F flat 08
2F flat 15
2F flat 17
2F flat 21
2F flat 25
3F flat 05
3F flat 15
4F flat 05
4F flat 13
4F flat 15
4F flat 15
5F flat 01
5F flat 11
6F flat 01
6F flat 11

3.1.2 Each of the 3 Scenarios is accompanied by a table of results showing whether the particular space (LKD or bedroom) complies with the TM59 criteria described in Section 2. A short discussion of the results is also provided in each subsection.

3.3 Scenario A

3.3.1 For each of the two TM59 Criteria, there were failures – in particular in relation to bedrooms where none of the spaces passed the compliant target of 33 hours per year.

TM59 Criterion (a) (a.k.a TM52 Criterion 1)

SCENARIO A: CRITERION (a)			
FLAT	LKD	BED	BED
1F flat 05	YES	YES	YES
1F flat 15	YES	YES	YES
2F flat 05	YES	YES	YES
2F flat 07	YES	YES	N/A
2F flat 08	YES	YES	N/A
2F flat 15	YES	YES	YES
2F flat 17	NO	NO	NO
2F flat 21	NO	NO	NO
2F flat 25	NO	NO	NO
3F flat 05	YES	YES	YES
3F flat 15	YES	YES	YES
4F flat 05	YES	YES	YES
4F flat 13	YES	YES	N/A
4F flat 15	YES	YES	YES
5F flat 01	YES	YES	YES
5F flat 11	YES	YES	YES
6F flat 01	YES	YES	YES
6F flat 11	YES	YES	YES

TM59 Criterion (b) - Bedrooms

SCENARIO A: CRITERION (b)	
FLAT	COMPLIANT?
1F flat 05 bed	FAIL
1F flat 05 bed	FAIL
1F flat 15 bed	FAIL
1F flat 15 bed	FAIL
2F flat 05 bed	FAIL
2F flat 05 bed	FAIL
2F flat 07 bed	FAIL
2F flat 08 bed	FAIL
2F flat 15 bed	FAIL
2F flat 15 bed	FAIL
2F flat 17 bed	FAIL
2F flat 17 bed	FAIL
2F flat 21 bed	FAIL
2F flat 21 bed	FAIL
2F flat 25 bed	FAIL
2F flat 25 bed	FAIL
3F flat 05 bed	FAIL
3F flat 05 bed	FAIL
3F flat 15 bed	FAIL
3F flat 15 bed	FAIL
4F flat 05 bed	FAIL
4F flat 05 bed	FAIL
4F flat 13 bed	FAIL
4F flat 15 bed	FAIL
4F flat 15 bed	FAIL
5F flat 01 bed	FAIL
5F flat 01 bed	FAIL
5F flat 11 bed	FAIL
5F flat 11 bed	FAIL
6F flat 01 bed	FAIL
6F flat 01 bed	FAIL
6F flat 11 bed	FAIL
6F flat 11 bed	FAIL

3.4 Scenario B

3.4.1 The ability to open windows at night if needed, combined with the use of external blinds during the day, ensures that both criteria are complied with under this scenario.

TM59 Criterion (a) (a.k.a TM52 Criterion 1)

SCENARIO B: CRITERION (a)			
FLAT	LKD	BED	BED
1F flat 05	YES	YES	YES
1F flat 15	YES	YES	YES
2F flat 05	YES	YES	YES
2F flat 07	YES	YES	N/A
2F flat 08	YES	YES	N/A
2F flat 15	YES	YES	YES
2F flat 17	YES	YES	YES
2F flat 21	YES	YES	YES
2F flat 25	YES	YES	YES
3F flat 05	YES	YES	YES
3F flat 15	YES	YES	YES
4F flat 05	YES	YES	YES
4F flat 13	YES	YES	N/A
4F flat 15	YES	YES	YES
5F flat 01	YES	YES	YES
5F flat 11	YES	YES	YES
6F flat 01	YES	YES	YES
6F flat 11	YES	YES	YES

TM59 Criterion (b) - Bedrooms

SCENARIO B: CRITERION (b)	
FLAT	COMPLIANT?
1F flat 05 bed	YES
1F flat 05 bed	YES
1F flat 15 bed	YES
1F flat 15 bed	YES
2F flat 05 bed	YES
2F flat 05 bed	YES
2F flat 07 bed	YES
2F flat 08 bed	YES
2F flat 15 bed	YES
2F flat 15 bed	YES
2F flat 17 bed	YES
2F flat 17 bed	YES
2F flat 21 bed	YES
2F flat 21 bed	YES
2F flat 25 bed	YES
2F flat 25 bed	YES
3F flat 05 bed	YES
3F flat 05 bed	YES
3F flat 15 bed	YES
3F flat 15 bed	YES
4F flat 05 bed	YES
4F flat 05 bed	YES
4F flat 13 bed	YES
4F flat 15 bed	YES
4F flat 15 bed	YES
5F flat 01 bed	YES
5F flat 01 bed	YES
5F flat 11 bed	YES
5F flat 11 bed	YES
6F flat 01 bed	YES
6F flat 01 bed	YES
6F flat 11 bed	YES
6F flat 11 bed	YES

3.5 Scenario C

3.5.1 The scenario is included for comparison, and assumes no blinds but the ability to open windows and doors 'at will'. Whilst the figures are slightly higher in terms of Criterion (b) compared to Scenario B, this is expected because Scenario B has significantly reduced solar gain during the day because of the blinds.

3.5.2 The tables here however do hide a slightly higher risk for some of the rooms, which have been coloured blue, for information only. As part of the analysis we also extract from the model the results for TM52 Criteria 2 and 3. It is not a requirement for TM59 for these to be met, so to simplify matters we don't typically report on them in any detail. However for those units shaded blue, these additional TM52 criteria do show an elevated risk, and indicate that even if the noise issue did not apply, the use of mitigation such as that in Scenario B could be important.

TM59 Criterion (a) (a.k.a TM52 Criterion 1)

SCENARIO C: CRITERION (a)			
FLAT	LKD	BED	BED
1F flat 05	YES	YES	YES
1F flat 15	YES	YES	YES
2F flat 05	YES	YES	YES
2F flat 07	YES	YES	N/A
2F flat 08	YES	YES	N/A
2F flat 15	YES	YES	YES
2F flat 17	YES	YES	YES
2F flat 21	YES	YES	YES
2F flat 25	YES	YES	YES
3F flat 05	YES	YES	YES
3F flat 15	YES	YES	YES
4F flat 05	YES	YES	YES
4F flat 13	YES	YES	N/A
4F flat 15	YES	YES	YES
4F flat 15	YES	YES	YES
5F flat 01	YES	YES	YES
5F flat 11	YES	YES	YES
6F flat 01	YES	YES	YES
6F flat 11	YES	YES	YES

TM59 Criterion (b) - Bedrooms

SCENARIO C: CRITERION (b)		
FLAT	HOURS	COMPLIANT?
1F flat 05 bed	11	YES
1F flat 05 bed	12	YES
1F flat 15 bed	12	YES
1F flat 15 bed	10	YES
2F flat 05 bed	4	YES
2F flat 05 bed	4	YES
2F flat 07 bed	8	YES
2F flat 08 bed	8	YES
2F flat 15 bed	4	YES
2F flat 15 bed	7	YES
2F flat 17 bed	9	YES
2F flat 17 bed	9	YES
2F flat 21 bed	9	YES
2F flat 21 bed	10	YES
2F flat 25 bed	9	YES
2F flat 25 bed	10	YES
3F flat 05 bed	9	YES
3F flat 05 bed	11	YES
3F flat 15 bed	10	YES
3F flat 15 bed	9	YES
4F flat 05 bed	4	YES
4F flat 05 bed	8	YES
4F flat 13 bed	9	YES
4F flat 15 bed	9	YES
4F flat 15 bed	10	YES
5F flat 01 bed	9	YES
5F flat 01 bed	9	YES
5F flat 11 bed	10	YES
5F flat 11 bed	9	YES
6F flat 01 bed	9	YES
6F flat 01 bed	9	YES
6F flat 11 bed	12	YES
6F flat 11 bed	10	YES

4 Conclusions and Recommendations

4.1.1 This analysis has established that without any mitigation, there will be an overheating risk to the apartments at the proposed development at Comet Way. This overheating risk is exacerbated significantly when windows are required to be closed.

4.1.2 As things stand, if the noise criterion is to take precedence, then the building will not be able to meet the recommended CIBSE criteria in relation to overheating, even with mitigation measures in place. This is reflected in results of Scenario A in Section 3, which shows that even with MVHR – where we have used reasonable and recognised assumptions about performance, capacity, air change rates, efficiency, etc – overheating will predominate, especially in bedrooms.

4.1.3 The appropriate mitigation identified – lower g-value glazing and external shutters/blinds, has a significantly beneficial impact: from the perspective of main living spaces the building will in the majority of cases (but not all) comply. However, the lack of ability to purge ventilate the bedrooms and rapidly remove warm air, for which we cannot solely rely on an MVHR system, means those bedrooms don't comply.

4.1.4 In practice the building as designed and to be constructed will not have fixed windows to bedrooms and living spaces. All windows will be openable – this is for the reasons of quality of life, fire safety and escape, and – ultimately - for purge ventilation. This is irrespective of the noise issue and associated requirements. Arguably it should be the choice of the resident as to whether they decide to live at Comet Way, provided they have the full information to hand.

4.1.5 We have identified that the overheating risk under Scenario B is very low – where windows can be opened at night in periods of particularly hot weather - and we would argue that this is a sensible compromise between the two competing issues of ambient/external noise and overheating. For those sunny periods where there are high solar gains and high air temperatures, we propose that windows should be considered as openable at night (when ambient noise levels will be lower).

4.1.6 This, combined with the introduction of lower g-value glazing and the installation of external blinds on 'higher risk' elevations, combined with MVHR, should be an acceptable solution. It means residents can strike the right balance between dealing with noise and overheating, but to do so in a way that gives them the choice of how they wish to live and use their living spaces.

4.1.7 Finally, it should of course be noted that CIBSE Guidance is just that – guidance. It provides a robust method of assessing overheating risk and drives good design and best practice and we strongly recommend it is adhered to, but it is not a regulatory requirement. Ultimately the decision on whether or not this development should proceed should be a balanced judgement between a reasonable approach to addressing noise, mitigating overheating risk and the need for this housing in Hatfield. This report has demonstrated that all three should be achievable in practice.