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31st January 2022
Your Ref. 200328
Our Ref. P122264-1000

Dear Brian

BRE Review of Wind Assessment in Respect of Outline Planning Application 200328 at Vastern Court, Caversham Road, Reading

1. Background and Scope of this Review

An application for outline planning permission (Ref 200328) has been submitted to Reading Borough Council for a site known as Vastern Court. The site lies immediately adjacent to the railway station at the northern edge of Reading town centre. The River Thames is to the North of the site, with the open green spaces of Christchurch Meadows beyond that. The site is located at the centre of a planned pedestrian and cycle route north from the station to the river.

BRE have been appointed by Reading Borough Council (RBC) to undertake an independent peer review of the Wind Microclimate Chapter of the Environmental Statement and the supporting Technical Report, and to provide an opinion on whether:

- a) The level and nature (including the methodology) of information submitted is sufficient and proportionate to the proposed level of outline development sought in this instance.
- b) The analysis and conclusions reached within the relevant sections of the ES are reasonable and robust, set within the adopted local policy context of:

Relevant components of Policies CC3 (Adaption to Climate Change), CC8 (Safeguarding Amenity) and CR10 (Tall Buildings) of the Reading Borough Council Local Plan 2019.

- c) If it is considered that the analysis / conclusions are not reasonable and robust for such an outline permission, guidance as to what measures (e.g. alternative mitigation measures) / information would be required to address any concerns raised (if any)?



BRE's Quality Management system is certified to ISO 9001:2015 Certificate Number LRQA 10049560.

BRE's Environmental Management System is certified to ISO14001:2015 certificate number 10056985.

BRE's Health and Safety Management System Is certified to OHSAS 18001:2007 LRQA 10007555.

This review does not include a detailed technical appraisal and BRE have not conducted our own technical assessment.

2. Review of the Technical Appendix 9.1 Wind Microclimate prepared by Xi Engineering Consultants Ltd

2.1 Legislation and Planning Policy Context

This section considers National, Regional and Local planning policy. The London Plan is cited under regional planning policy. This only strictly applies to the Greater London Area so might not be appropriate for Reading. Only Policies CC3 (Adaption to Climate Change) and CC8 (Safeguarding Amenity) of the Reading Borough Council Local Plan 2019 are considered.

BRE Comment: Policy CR10 (Tall Buildings) has been omitted and should be considered.

2.2 Methodology and Modelling

The Wind Microclimate Assessment has been carried out using the SimScale CFD simulation software and provides a quantitative assessment of the expected suitability of wind conditions for pedestrian comfort and safety. CFD is an acceptable methodology for wind microclimate assessments.

The CFD model includes buildings within a 300m radius of the application site. This is considered to be acceptable.

The scenarios considered are the existing site and surrounding conditions (baseline scenario), the proposed development including existing surrounding developments and the proposed development including future cumulative surrounding developments. This is consistent with the requirements of an EIA.

It is not clear what level of detail has been used in the modelling of the target buildings. Figures 4, 5 and 6 appear to show the target buildings as simple rectangular blocks. It is normal good practice to model all building features larger than about 300mm in extent. However, as this is an outline planning application a reduced level of modelling detail might be appropriate.

BRE Comment: Clarification of the level of detail used in the modelling of the target buildings should be provided and justified.

The report does not mention whether landscaping has been modelled.

BRE Comment: Please confirm whether landscaping measures have been incorporated in the assessment.

2.3 Assessment Criteria

The study states that it uses the Lawson Criteria for assessing the suitability of the wind conditions for pedestrian comfort and safety. The Lawson criteria used by Xi Engineering Consultants are shown in Figure 1 below. The Lawson Criteria is widely used in the UK and is the standard approach for wind microclimate assessments. However, there are several variations of the Lawson criteria which use different threshold wind speeds and probabilities of exceedance, see for example the original Lawson criteria (shown in Figure 2) the City of London criteria (shown in Figure 3) and the London Docklands Development Corporation (LDDC) version (shown in Figure 4).

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Strolling
E	10 m/s	< 5%	Walking
U	10 m/s	> 5%	Uncomfortable

Figure 1 Comfort criteria used by Xi Engineering Consultants, we believe incorrectly attributed to Lawson

Activity	Lawson comfort criteria	
	Unacceptable	Tolerable
Roads and car parks, business walking, fast walking from A to B	10.7 m/s (B5) > 6%	10.7 m/s (B5) > 2%
People at work, workers around buildings	10.7 m/s (B5) > 2%	7.9 m/s (B4) > 2%
Pedestrian strolling, slow walking with occasional stops, shopping, short-term standing eg at bus stops	7.9 m/s (B4) > 4%	5.4 m/s (B3) > 6%
Long-term sitting – in open-air cafes, parks, etc. for periods of more than about 10 min	5.4 m/s (B3) > 6%	3.3 m/s (B2) > 6%
Entrances and exits of buildings or areas where there is a risk of sudden exposure to wind	5.4 m/s (B3) > 6%	3.3 m/s (B2) > 4%
Covered areas – pedestrian seating areas under cover, places of high cultural significance	5.4 m/s (B3) > 1%	3.3 m/s (B2) > 4%

Figure 2 Original Lawson comfort criteria

Category	Mean and GEM wind speed (5% exceedance)	Description
Frequent Sitting	2.5m/s	Acceptable for frequent outdoor sitting use, e.g. restaurant, café.
Occasional Sitting	4m/s	Acceptable for occasional outdoor seating, e.g. general public outdoor spaces, balconies and terraces intended for occasional use, etc.
Standing	6m/s	Acceptable for entrances, bus stops, covered walkways or passageways beneath buildings.
Walking	8m/s	Acceptable for external pavements, walkways.
Uncomfortable	>8m/s	Not comfortable for regular pedestrian access.

Figure 3 City of London modified Lawson comfort criteria

Category	Mean and GEM windspeed (5% exceedance)	Description
Business Walking	10m/s	Objective walking from A to B or cycling
Pedestrian Walking	8m/s	Walking
Pedestrian Standing	6m/s	Standing or short-term sitting
Pedestrian Sitting	4m/s	Long-term sitting

Figure 4 Lawson LDDC criteria

The Xi Engineering Consultants report does not specify which version of the Lawson criteria is used for pedestrian comfort. For Pedestrian safety it is stated that the Lawson LDDC criteria have been used. This follows normal good practice. However, the criteria used for pedestrian comfort do not appear to correspond to the LDDC criteria or any other published version of the Lawson criteria that we are aware of. Furthermore the criteria used appear to be unduly lenient for some activities. For example, for walking the acceptability criteria used in this report is 5%

exceedance of 10m/s, whereas all published versions of the Lawson criteria use a wind speed limit of 8m/s for walking.

BRE Comment: Full details of the Lawson criteria used for pedestrian comfort must be provided and justified.

All wind microclimate assessments using the Lawson criteria require both an assessment of the mean wind speeds and the gust wind speeds where the gust wind speeds are presented as Gust Equivalent Mean wind speeds (GEM). The Xi Engineering Consultants assessment only appears to have considered the mean wind speeds. This is a serious omission which could lead to an underestimate of the wind effects.

BRE Comment: The effects of gust wind speeds presented as GEMs must be included in this wind comfort assessment.

The Xi Engineering Consultants report uses an acceptability mean wind speed limit of 15m/s for Strong Winds (safety). This is consistent with accepted best practice. However an assessment of the GEM speeds must also be carried out.

BRE Comment: The effects of gust wind speeds presented as GEMs must be included in this wind safety assessment.

2.4 Meteorological Data

The report does not give any details of the raw meteorological data used or how these data have been transformed from the Met site to the Application site.

BRE Comment: The location of the weather station used in this assessment must be provided and ideally wind roses from that weather station should also be included in order to assess whether the data are appropriate for the Application site. Details of how the data from the weather station have been transformed to the Application site must also be included.

2.5 Results

Figures 10 to 14 show the results from the pedestrian comfort assessment for the three test configurations and Figures 15 to 19 show the results from the strong winds (safety) assessment.

Both sets of figures use the same colour scheme, except that in the wind comfort assessments the colour red is used to signify a wind speed of 10m/s but in the wind safety assessments the same colour red signifies a wind speed of 15m/s. This is confusing to the reader.

BRE Comment: It is recommended that different colours be used to signify different wind speeds.

Some of the results are unexpected. For example Figure 11 shows that the wind conditions at ground level in the gaps between the proposed buildings are generally suitable for walking or strolling, but Figure 16 shows that the wind conditions in these same areas are mostly unsafe, see Figure 5 below which shows a comparison of these figures. Also, compare the 'unsafe' conditions shown in Figure 15 to the North the site (e.g. between the existing low-rise buildings and in an open space to the East of the lines of terraced buildings) with Figure 10 where these zones are suitable for 'strolling' and 'pedestrian sitting'. These inconsistent results suggest that there is something wrong with the approach being used. **BRE Comment: Please check and confirm that the results are correct.**

There are other potential issues with the modelling of the wind conditions on the roof terraces. In all cases shown for both wind comfort and wind safety on the roof terraces there are strong winds close to the roof edges. This will only be the case where there are no edge parapets, or the parapets are essentially completely air permeable. This suggests that the roof parapets have either not been modelled or have been modelled incorrectly. **BRE Comment: Please confirm whether the roof parapets have been correctly modelled.**

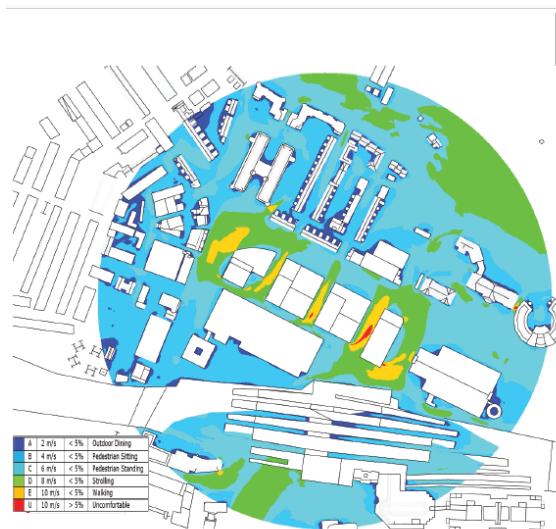


Figure 11 - Ground Level Lawson Comfort Criteria plot for Configuration 2: Completed Development

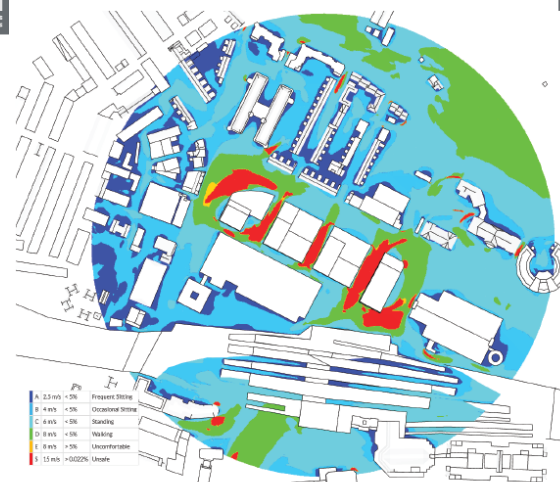


Figure 16 - Lawson LDDC unsafe Strong Wind classification for Configuration 2: Completed Development



Figure 5 Comparison between Figure 11 (wind comfort) and Figure 16 (wind safety)

The Document Summary to Technical Appendix 9.1 states, 'It contains additional discussion on method, results and mitigation as well as further technical details'. No details of mitigation measures or possible mitigation measures are included in this Appendix. Given the significant areas of unsafe wind speeds predicted to occur on and around this proposed development, it is essential that, as a minimum, a discussion of potential or outline mitigation measures is included. **BRE Comment: Potential mitigation measures must be proposed, and their efficacy discussed.**

2.6 Summary of comments on Technical Appendix

Table 1 below includes a list of further information and/or clarification required by BRE with regards to the Technical Appendix 9.1.

Appendix 9.1 Section No	Issue	Reviewer Comment
2.4	Omission	Reading Borough Council Local Plan Policy CR10 (Tall Buildings) has not been considered
5.2	Clarification	More information should be provided and justified regarding the level of detail used in the modelling of the target buildings
5.2	Clarification	Confirm whether landscaping measures have been incorporated in the CFD model
5.0	Omission	Provide full details of the Lawson criterion used for pedestrian comfort
5.0	Omission	The assessment does not appear to include the effects of gust wind speeds (GEM) in the pedestrian comfort assessment. This is an essential requirement and must be included
5.0	Omission	The assessment does not appear to include the effects of gust wind speeds (GEM) in the pedestrian safety assessment. This is an essential requirement and must be included
6.0	Omission	The location of the weather station used in this assessment must be provided and ideally wind roses from that weather station should be included in order to assess whether the data are appropriate for the Application site
6.0	Omission	Details of how the data from the weather station have been transformed to the Application site must be included
7.0 & 8.0	Clarification	It is recommended that different colours be used to signify different wind speeds.
7.0 & 8.0	Clarification	There is a potential lack of correlation between some wind comfort and wind safety results. Please check and confirm that the results from the CFD analysis are correct.
7.0 & 8.0	Clarification	There are some unexpected results around the edges of the roof terraces. Please confirm whether the roof parapets have been correctly modelled.
New Section	Omission	No discussion of, or proposals for, mitigation measures is included. Given the significant areas of unsafe wind speeds predicted to occur on and around this proposed development, it would be expected that potential mitigation measures and their efficacy is discussed

Table 1 Summary of issues to be addressed

3. Review of ES Chapter 9 Wind Microclimate

3.1 Policies, Guidance, Legislation and Standards

Appropriate policies and guidance are noted in this chapter and inform the assessment of the wind microclimate.

3.2 Scope

The Technical, Spatial and Temporal scope are all considered to be appropriate

3.3 Meteorological data

It is stated that the wind data for the Reading area was sourced from Meteoblue and uses simulated (predicted) weather data rather than actual data measured from a nearby weather station. **BRE Comment: Further information is required in order to assess whether this wind data is appropriate for the Application Site.**

The wind microclimate assessment has been carried out for 16 wind directions, this is acceptable.

3.4 Assessment Methodology

The following three scenarios have been considered:

Configuration 1: Existing baseline

Configuration 2: Existing baseline + proposed development

Configuration 3: Existing baseline + proposed development + cumulative schemes

This accords with normal best practice

The assessment of wind conditions for these three scenarios has been undertaken using SimScale Computational Fluid Dynamics Software (CFD). **BRE Comment: CFD is considered to be an acceptable approach providing it considers both mean and gust equivalent mean (GEM) effects. Please confirm whether the SimScale CFD analysis includes an assessment of gust wind speeds.**

The assessment of wind effects during demolition and construction have been assessed using the professional judgement. This is acceptable practice.

The assessment says that it uses the LDDC variant of the Lawson Criteria for both pedestrian comfort and safety. However, this is not strictly correct. The criteria as used includes an additional category for outdoor dining; whilst introducing new criteria can be done (and is sometimes necessary) such new criteria are not part of the Lawson LDDC criteria. Furthermore some Comfort Category names have been changed, i.e. the 'Strolling' category should be renamed 'Walking' and the 'Walking' category should be renamed 'Business walking'. This might seem to be a trivial issue but there are different connotations associated with areas that are acceptable for 'Walking' and for 'Business walking'. **BRE Comment: It is recommended that a note is added to make it clear that the comfort criteria used are a variant of the Lawson LDDC criteria or the definitions are changed to be consistent with the Lawson LDDC criteria.**

3.5 Target Wind Conditions

The results for pedestrian comfort and safety have only been presented as annual averages for the year as a whole. This is not best practice. The Lawson assessment methodology requires a seasonal approach in order to allow the wind conditions to be assessed for suitability for every season and for the year as a whole.

The target wind conditions presented in this Chapter are only defined on a seasonal basis. For example, it is stated that for public amenity spaces, the target wind condition is sitting during the summer months. Table 9.3 which presents the target wind conditions for other intended uses also only presents these criteria for the summer and winter periods. ***BRE Comment: We agree with these seasonal target conditions. However, the assessment of wind conditions has only been carried out for the year as a whole. It is therefore not possible to assess any of these seasonal target conditions. The report must fully explain how the assessment of the target wind conditions has been carried out when the data are not available.***

3.6 Significance Criteria

The significance criteria used are consistent with normal best practice, and the assignment of a major adverse effect for breach of safety criteria for strong winds is considered acceptable.

3.7 Results

The CFD simulation provides results over the whole calculation area. For the purposes of this assessment 50 representative measurement locations have been chosen and the results presented for these locations. This approach aids presentation and discussion of the results. A typical wind tunnel assessment would have 150 to 200 measurement locations, but the results presented here also include the coloured 'heat' maps so 50 specific locations is considered acceptable.

3.7.1 Configuration 1: Baseline Configuration

The pedestrian comfort wind conditions at all locations are suitable for Strolling or more sedentary activities at all locations. The report states 'There are no instances of winds exceeding 15 m/s for more than 0.025 % of the time in this configuration within or close to the application site.' This is correct, however, there are several locations further afield where the safety threshold is exceeded.

Given the massing and layout of the existing buildings on the Application site these wind conditions are generally as expected.

3.7.2 Configuration 2: Existing Baseline + Proposed Development

Pedestrian Comfort

The ground level wind conditions around the proposed development are generally windier than the baseline conditions at all locations. The report provides a detailed assessment of the conditions on-site in thoroughfares, pedestrian crossings, entrances, ground level and roof level amenity areas. In most cases the effect of these pedestrian comfort wind conditions have been assessed as being within the range negligible to moderate adverse. We agree with these assessments based on the results presented. However, it should be noted that the wind conditions at the ends of and in the thoroughfares between the four proposed new buildings are shown as being suitable for 'Walking'. According to the Lawson LDDC criteria this is actually suitable for 'Business walking', i.e. fast walking with a purpose from A to B. Such conditions are not desirable around a new development and would be unlikely to meet the requirements of CR10 (Tall Buildings) of the Reading Borough Council Local Plan 2019.

BRE Comment: Comparing Figures 9.5 and 9.6 it can be seen that the proposed development will also increase wind speeds in some areas off-site, for example at the existing building entrances on Caversham Road and the bus stop outside the railway station where the conditions would worsen and become unsuitable for the intended pedestrian activities. This will have an adverse impact on the surrounding area which should be assessed.

The wind conditions on the rooftop amenity areas are also generally unsuitable for the intended pedestrian activity (amenity usage). The effect of the wind conditions on these terraces have been assessed as being within the range minor beneficial to major adverse. Whilst it is correct that some areas (on the lower roof terraces) have conditions that are suitable for outdoor dining (minor beneficial), these areas are so small that it is unlikely that they could practically be used for this purpose. ***BRE Comment: a more realistic assessment of roof terrace conditions would be negligible to major adverse.***

Pedestrian Safety

Unsafe, strong winds are predicted to occur at many ground level locations around the proposed development and further afield in the existing areas surrounding the development. Areas particularly affected are the thoroughfares between the four new buildings, at the northern corner of Building A, at the southern corner of Building D and the north-east corner of Building D. Large areas of the roof terraces are also expected to have unsafe wind conditions. All areas where unsafe wind conditions are expected to occur have been assessed as having a major adverse impact. ***BRE Comment: we agree with this assessment based on the results presented, however we are not convinced that the underlying CFD assessment of pedestrian safety is correct.***

Assessment of Residual Effects

It is acknowledged that there are a large number of locations where unacceptable or unsafe wind conditions are expected to occur in and around the proposed development and that wind mitigation measures will be required. A list of possible/potential wind mitigation measures is given. None of these mitigation measures has been assessed because this is an outline proposal. ***BRE Comment: if the large areas of unsafe wind conditions predicated by the CFD assessment are correct then in BRE's opinion the possible/potential mitigation measures are unlikely to be adequate to mitigate the wind speeds over such large areas.***

It is stated that a planning condition would be sought to undertake wind tunnel testing at the detailed design stage to refine and assess the effectiveness of these mitigation measures. It is suggested that a wind tunnel assessment combined with professional judgement and experience could successfully mitigate the significant adverse and unsafe effects identified. ***BRE Comment: we agree that this would be an appropriate course of action by the Applicant.***

3.7.3 Configuration 3: Existing Baseline + Proposed Development + Cumulative Schemes

The following cumulative schemes have been included within this assessment:

- Former BMW Site – Thames Quarter
- Station Hill
- 29 Station Road Reading
- Network Rail Thames Valley Area site office/ Former Royal Mail site
- Former Scottish and Southern Energy site

BRE have not checked that this is a complete list of nearby proposed/consented schemes and Reading Borough Council should satisfy themselves that this is a complete and appropriate list.

Pedestrian Comfort

The inclusion of the cumulative schemes has a significant beneficial impact on the ground level wind microclimate compared with Configuration 2. Whilst the ground level wind speeds are still generally stronger than those expected around the baseline conditions they are mostly acceptable for the intended pedestrian activities. However, there are some windy areas particularly around Building A where uncomfortable winds occur at location 2 and conditions suitable for (Walking), actually Business walking, at locations 10 and 34. All roof terraces still experience some areas which are expected to be uncomfortable. The assessment of the effects range from minor beneficial to major adverse.

Pedestrian Safety

The cumulative schemes reduce the extent of the areas of unsafe ground level wind speeds although several large areas of unsafe wind conditions remain, particularly around Blocks A and D. In this scenario there are also new areas of unsafe wind conditions which occur near to measurement location 41 and around the existing buildings to the north (there is no measurement number here).

The areas of unsafe wind conditions on the roof terraces are largely unaffected by the presence of the cumulative schemes and remain similar to conditions in Configuration 2.

The effects of the strong wind conditions for Configuration 3 appear to range from minor beneficial to major adverse. However, an assessment of these effects has not been included in this Section. ***BRE Comment: An assessment of the effects of the strong wind conditions should be provided.***

4 Concluding Comments

The wind microclimate Technical Appendix and ES Chapter as reviewed herein are for an outline planning application.

The level and nature of information submitted in the Technical Appendix is not considered to be sufficient or robust. There are several omissions and/or clarifications required in the Technical Appendix, in particular with regards to whether the effects of gust wind speed has been considered. Section 5.3.47 of the Reading Borough Council Local Plan states that '*Wind should be assessed against the Lawson Criteria*', the assessment as presented does not fully implement the Lawson methodology because a seasonal analysis of wind conditions has not been presented.

As mentioned in this review, at some locations the predicted wind safety conditions are not credible.

The analysis and conclusions reached within the wind microclimate chapter of the ES (Chapter 9) are generally reasonable and robust, based on the results presented. Some clarification and additional information is required, as indicated in Section 3 of this review, in particular with reference to how the seasonal target wind conditions were assessed when only annual data are presented.

The relevant components of Policies CC3 (Adaption to Climate Change) and CC8 (Safeguarding Amenity) of the Reading Borough Council Local Plan 2019 have been considered. However,

Policy CR10 (Tall Buildings) has not been cited as relevant local planning policy so it is not clear if this has been considered – this should be confirmed.

The wind microclimate assessment predicts that there will be several areas around the proposed scheme where the wind conditions will be either uncomfortable or unsafe. Such conditions would be unacceptable. Mitigation measures are suggested, which could be conditioned and implemented at the detail design stage. We agree that the efficacy of these measures should be established via a wind tunnel assessment,

Yours sincerely



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