

SHARPS REDMORE

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Report

Proposed Mixed Use Retail and Residential Development

Morrisons, 43 – 67 High
Street, Yiewsley

Noise Assessment

Prepared by

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Project No 1817625

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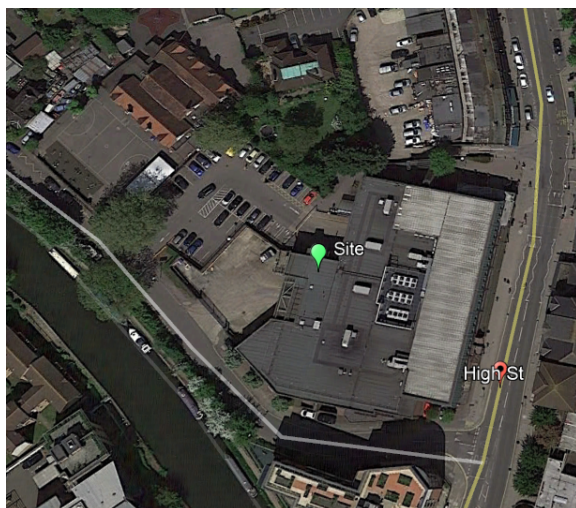
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1.0 Introduction

- 1.1 Sharps Redmore (SR) have been instructed by Harbourside Investments Ltd and WM Morrisons Supermarkets PLC to carry out a noise assessment for the redevelopment of the existing Morrisons supermarket, 43 – 67 High Street, Yewlsey, UB7 7QQ. The site location is shown in Figure 1 below:

FIGURE 1: Site Location



- 1.2 This report accompanies the planning application for the demolition of the existing buildings and the redevelopment of the site to provide a retail and residential mixed use scheme. The site will be developed to provide a replacement Morrisons foodstore, with 144 residential units provided above.
- 1.3 The purpose of this report is to assess the impact of noise on and from the development on both existing and proposed residential noise sensitive properties. Based on experience of similar sites the following potential impacts have been identified:
- Noise impact from existing noise sources, road traffic, on proposed residential apartments;
 - Noise impact from proposed commercial use on existing and proposed residential properties;
- 1.4 The assessment is based on planning drawings submitted with the application.
- 1.5 The report is structured as follows:
- Section 2.0 - A discussion of the available methods of assessment and assessment criteria.
 - Section 3.0 - Details of the environmental noise survey and initial site noise risk assessment (in accordance with the requirements of the latest ProPG planning guidance, as discussed further in Section 2).
 - Section 4.0 - The impact of existing noise sources on the proposed residential apartments.
 - Section 5.0 - The impact of proposed commercial use on existing and proposed residential properties.
 - Section 6.0 – Summary and Conclusions

2.0 Assessment methodology and criteria

Planning Policy Context

National Policy

- 2.1 The National Planning Policy Framework (NPPF), July 2018, sets out the Government's planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 180 of the NPPF states the following:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation".*

- 2.2 Guidance on the interpretation of the policy aims contained within the NPPF is contained within National Planning Policy Guidance (NPPG). The NPPG introduces the concept of a noise exposure hierarchy based on likely average response. The guidance contained in the NPPG is summarised in the table below:

TABLE 1: Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed	

Perception	Examples of Outcomes	Increasing Effect Level	Action
		Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

- 2.3 The NPPF and NPPG reinforce the March 2010 DEFRA publication, “Noise Policy Statement for England” (NPSE), which states three policy aims, as follows:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.”*

- 2.4 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

“... all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur.”

Design Guidance

National Design Guidance

- 2.5 It is possible to apply objective standards to the assessment of noise and the effect produced by the introduction of a certain noise source may be determined by several methods, as follows:

- i) The effect may be determined by reference to guideline noise values. British Standard (BS) 8233:2014 and World Health Organisation (WHO) “*Guidelines for Community Noise*” contain such guidelines.
- ii) Alternatively, the impact may be determined by considering the change in noise level that would result from the proposal, in an appropriate noise index for the

characteristic of the noise in question. There are various criteria linking change in noise level to effect. This is the method that is suited to, for example, the assessment of noise from road traffic because it is capable of displaying impact to all properties adjacent to a road link irrespective of their distance from the road.

- iii) Another method is described within BS 4142:2014 to determine the significance of sound impact from sources of industrial and/or commercial nature. The sources that the newly revised standard is intended to assess are sound from industrial and manufacturing processes, sound from fixed plant installations, sound from loading and unloading of goods at industrial and/or commercial premises and the sound from mobile plant and vehicles, such as forklift, train or ship movements.

Guideline noise values

- 2.6 There are a number of guidance documents that contain recommended guideline noise values. These are discussed below.

Impact of existing noise sources on proposed residential properties

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings.

- 2.7 The current nationally recommended internal noise levels for dwellings are given in BS 8233:2014 'Guidance on Sound Insulation & Noise Reduction for Buildings'. BS 8233 recommends the following internal noise standards:

TABLE 2: Guideline noise values

BS 8233:2014 Table 4 – Indoor ambient noise levels for dwellings			
Activity	Location	0700 to 2300	2300 to 0700
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

- 2.8 The previous version (1999) of BS 8233 contained two guidelines for internal criteria; good and reasonable. The difference between the good and reasonable criteria was 5 dB. Whilst the 5 dB relaxation in noise criteria is not specifically referred to in the table above, Note 7 advises that *“where development is considered necessary or despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.”*
- 2.9 There is no longer a L_{AMAX} standard for bedrooms in BS 8233. However, footnote 4 to Table 4 states that *“Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values.”* In this case, it is proposed that the previous BS8233 internal standard (also referenced in World Health Organisation Guidelines for Community Noise) is applied. This is 45 dB L_{AMAX} , inside bedrooms.

External Areas (Garden and Balconies)

- 2.10 For outdoor areas (i.e. balconies), BS 8233:2014 recommends that “it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB

L_{AeqT} ” However, the document recognises that that these guideline values are not achievable in all circumstances and in higher noise areas, a compromise might be warranted. In such circumstances, development should be designed to achieve the lowest practicable levels in these external amenity spaces.

- 2.11 The Planning Practice Guidance on Noise, published on [planningportal.gov.uk](https://www.planningportal.gov.uk), gives further consideration relating to mitigating the impact of noise on residential developments and considers that noise may be partially off-set if residents of the dwellings have access to:

- A relatively quiet façade (containing windows to habitable rooms as part of their dwelling;
- A relatively quiet external amenity space for their sole use such as a balcony which is generally considered as desirable.
- A relatively quiet nearby external space for use by a number of residents as part of the amenity of their dwellings, and/or;
- A relatively quiet external, publicly accessible amenity space that is nearby (e.g. within a 5 minute walk)

ProPG: Planning and Noise – New Residential Development

- 2.12 The ProPG professional practice guidance on planning and noise has been jointly produced by the Chartered Institute of Environmental Health (CIEH), Institute of Acoustic (IOA) and Association of Noise Consultants (ANC).

- 2.13 The ProPG recommends a 2 stage approach; an initial assessment which identifies the risk of noise on the proposed planning application, and where the results indicate that noise requires further consideration a full assessment in the form of an Acoustic Design Statement (ADS) which would include four key elements as follows:

- Element 1 – demonstrating a “Good Acoustic Design Process”;
- Element 2 – observing internal “Noise Level Guidelines.”
- Element 3 – Undertaking an “External Amenity Area Noise Assessment”
- Element 4 – Consideration of “Other Relevant Issues.”

- 2.14 The advice contained within ProPG is based on the policy objectives contained within the NPPF and the objective noise guidelines within BS 8233:2014. However the ProPG does not constitute an official government code of practice.

Impact of commercial premises on residential properties

World Health Organisations Guidelines Values for Community Noise

- 2.15 The WHO guideline values are appropriate to what are termed “critical health effects”. This means that the limits are at the lowest noise level that would result in any psychological or physiological effect. They are, as defined by NPSE, set at the Lowest Observed Adverse Effect Level (LOAEL), but do not define the level above which effects are significant (the SOAEL). Compliance with the LOAEL should, therefore, be seen as a robust aim.

- 2.16 The National Physical Laboratory document *“Health Effect based noise assessment methods; a review and feasibility study”, (September 1998)* contains an “interpretation” of the WHO guidelines (then in draft form) for the DETR. The summary of this section of the NPL report states *“In essence, the WHO guidelines represent a consensus view of*

international expert opinion on the lowest threshold noise levels below which the occurrence rates of particular effects can be assumed to be negligible. Exceedances of the WHO guideline values do not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached” (paragraph 5.4).

- 2.17 The World Health Organisation guideline noise values are summarised in the following table:

TABLE 3: WHO guideline noise values

Document	Level	Guidance
World Health Organisation “Community Noise 2000”	$L_{AeqT} = 55 \text{ dB}$	Serious annoyance, daytime and evening. (Continuous noise, outdoor living areas)
	$L_{AeqT} = 50 \text{ dB}$	Moderate annoyance, daytime and evening. (Continuous noise, outdoor living areas).
	$L_{AeqT} = 35 \text{ dB}$	Moderate annoyance, daytime and evening. (Continuous noise, dwellings, indoors)
	$L_{AeqT} = 30 \text{ dB}$	Sleep disturbance, night-time (indoors)
	$L_{AMAX} = 60 \text{ dB}$	Sleep disturbance, windows open at night. (Noise peaks outside bedrooms, external level).
	$L_{AMAX} = 45 \text{ dB}$	Sleep disturbance at night (Noise peaks inside bedrooms, internal level)

- 2.18 For L_{AeqT} criteria the time base (T) given in the documents is 16 hours for daytime limits and 8 hours for night time limits. When assessing impact, this has the tendency to smooth out the hourly variations in noise level. As such, our calculations are carried out to a 1 hour time base, which is a more stringent assessment than is given in the WHO guidance document.
- 2.19 Where the existing ambient noise level is already above the criteria developed from the various guidance documents, it may be considered unreasonable to adopt such criteria. It would be reasonable, however, given the above statement from PPG 24 to consider criteria which do not exceed the existing noise climate, thus not giving rise to an overall 3 dB increase i.e. the minimum perceptible.

Changes in noise level

- 2.20 Changes in noise levels of less than 3 dBA are not perceptible under normal conditions and changes of 10 dBA are equivalent to a doubling of loudness. This guidance has been accepted by inspectors, at inquiry, to encompass changes in noise levels in the index L_{AeqT} .
- 2.21 Table 4 below shows the response to changes in noise (known as a semantic scale); this table has been developed from general consensus opinion of acousticians.

TABLE 4: Change in noise level

Change in noise level L_{AeqT} dB	Response	Impact
<3	Imperceptible	None
3 – 5	Perceptible	Slight/moderate
6 – 10	Up to a doubling	Moderate/significant
11 – 15	More than a doubling	Substantial
>15	-	Severe

- 2.22 Where the existing ambient noise level is already above the criteria developed from the various guidance documents, it may be considered unreasonable to adopt such criteria. It would be reasonable, however, given the above statement, to consider criteria which do not exceed the existing noise climate, thus giving rise to an overall 3 dB increase i.e. the minimum perceptible. If it is less than the minimum perceptible it cannot be described as disturbing or to affect the amenity of residents.

Assessment using BS 4142:2014

- 2.23 This British Standard enables the significance of sound impact to be determined in relation to industrial and commercial sources. The significance of sound impact is to be determined according to the following two stage process:
- 1) Assess background and residual noise levels; predict new noise levels, apply correction to predicted levels, as appropriate to arrive at a rating level and compare this rating level to the existing background level. Use this to make an initial estimate of impact; and
 - 2) Consider this level difference in the context of the site.
- 2.24 Matters which the standard recommends are relevant in order to consider context are, as shown in Table 5 below:

TABLE 5: BS 4142 notes on context

Factor	BS 4142 commentary	Notes
Absolute level of sound	<i>For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high</i>	Guidance on appropriate or significant absolute levels such as L_{Aeq} values for day or night or L_{Amax} values for night time can be found in the World Health

Factor	BS 4142 commentary	Notes
	<i>than for an acoustic environment where the residual sound level is low.</i> <i>Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.</i> <i>Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.</i>	Organisation's "Guidelines for Community Noise" and in British Standard BS 8233: 2014 "Guidance on sound insulation and noise reduction for buildings". When existing levels are low, particularly at night, absolute levels will often provide a better assessment tool. At night, the L_{Amax} factor will often be the key parameter to assess potential sleep disturbance.
The character and level of the residual sound compared to the character and level of the specific sound.	<i>Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.</i>	Experience and judgement will generally provide an excellent guide to determine the extent to which a specific sound might stand out or be in keeping with the existing surroundings. Whilst a technical assessment of character is sometimes desirable, it is also possible to consider character without the need for technical comparisons.
Sensitivity of receptor	<i>The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:</i> <i>i) facade insulation treatment;</i> <i>ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and</i> <i>iii) acoustic screening.</i>	If the existing noise sensitive premises (NSP) already have good quality windows (acoustically) and alternative means of ventilation or screening, then this needs to be considered. The intrinsic sensitivity of a particular use is also relevant. For example, whether the NSP is a school, office or dwelling is relevant.

Local Design Guidance

- 2.25 Local design guidance is found within the London Borough of Hillingdon Supplementary Planning Document on noise. This document which was produced in 2006, before the introduction of the NPPF and revisions of BS 8233 and BS 4142 and is based on the guidance of the now revoked PPG 24 "Planning and Noise".
- 2.26 With regard to new noise sensitive developments which are subject to transport related noise the guidance is as follows:

"When assessing a proposal for residential development subject to transport related noise, the Local Planning Authority will use Table 1 to determine which of the four Noise Exposure Categories (NEC's) A to D the proposed development site falls, taking into account both day and night-time noise levels."

Noise Exposure Categories.

Noise Exposure Category	A	B	C	D
Road Traffic Day (0700 -2300) Night (2300 – 0700)	<55 dB <45 dB	55 – 63 dB 45 – 57 dB	63 – 72 dB 57 – 66 dB	>72 dB > 66 dB
Rail Traffic Day (0700 – 2300) Night (2300 – 0700)	<55 dB <45 dB	55 – 66 dB 45 – 49 dB	66 – 74 dB 59 – 66 dB	>74 dB >66 dB
Air Traffic Day (0700 – 2300) Night (2300 – 0700)	< 57 dB < 48 dB	57 -66 dB 48 – 57 dB	66 – 72 dB 57 – 66 dB	> 72 dB > 66 dB

- 2.27 As stated above the guidance is based on the now revoked PPG 24 'Planning and Noise' and instead it is SR's view that greater regard should be had to the design guidance in BS 8233:2014 and ProPG, discussed above, which both focus on the achievement of acceptable living standards for future developments when the development is complete, rather than the outmoded PPG 24 and SPD approach that concentrates only on the open site external noise environment before development and before any mitigation measures are introduced.

3.0 Noise Survey details

- 3.1 A survey of existing noise levels was carried out between 16th and 17th April 2018. Measurements were carried out at three locations as shown in Figure 2 below and described in Table 6 below.

FIGURE 2: Noise monitoring locations

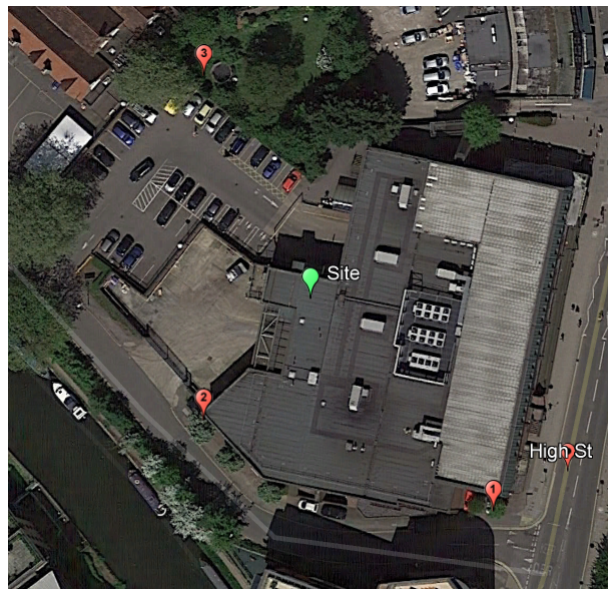


TABLE 6: Description of monitoring locations

Location	Equipment Used	Site Description
ML 1	SLM - Norsonic 118 Type 1 Calibrator – Norsonic	Attended measurements taken in line with façade of the store and proposed residential apartments overlooking High Street. Microphone located on a tri-pod approx. 1.5 metres above ground level in free-field conditions.
ML 2	SLM - Norsonic 118 Type 1 Calibrator - Norsonic	Attended measurements taken in line with the rear façade of the store and proposed residential apartments adjacent to St Stephens Road Microphone located on a tri-pod approx. 1.5 metres above ground level in free-field conditions
ML 3	SLM - Norsonic 140 Type 1 Calibrator - Norsonic	Unattended measurements taken at rear of service yard area/car park to establish existing background noise levels. Microphone located on mast approx. 3 metres above ground level in free-field conditions.

- 3.2 Weather conditions recorded during observations made on site were dry, with light breeze and were suitable for taking sound measurements.

Existing noise sources

- 3.3 The site is dominated by road traffic noise and pedestrian activity at the existing Morrisons store. At locations 1 and 2 attended measurements were specifically recorded over a 3 hour period allowing for an assessment of the $L_{A10,18hr}$ level in accordance with the shortened measurement procedure incorporated in the Calculation of Road Traffic Noise (CRTN). The night time noise level, L_{Aeq8hr} were estimated from the measures L_{Aeq} results recorded over the assumed loudest 4 hours of the night time period, between 2300 and 0100 hours and 0500 and 0700 hours. Assuming this level over the whole night period produces a robust estimation of the L_{Aeq} level that occurs over the 8 hour night. In reality the overall night time level will reduce with the quieter hours.

Survey Results

- 3.4 The results recorded during the survey are shown in Table 7 and Table 8 below. Full details of the results at ML3 are included within Appendix B to this report.

TABLE 7: Survey Results (ML1 and ML2)

Location	Start Time	L_{Aeq} (dB)	L_{A90} (dB)	L_{A10} (dB)	L_{Amaxf} (dB)
ML 1	13:30 hrs	70	58	71	76
	14:40 hrs	69	59	71	79
	13:25 hrs	68	59	70	78
	23:30 hrs	62	46	66	75
	00:40 hrs	61	44	65	78
	05:30 hrs	66	54	66	79
	06:15 hrs	67	55	70	78
ML 2	13:10 hrs	62	50	63	74
	14:20 hrs	59	51	64	74
	15:05 hrs	60	50	64	75
	23:00 hrs	52	49	57	68
	00:15 hrs	49	47	51	71
	05:20 hrs	54	50	60	73
	06:23 hrs	59	51	63	51

TABLE 8: Survey Results (ML3)

Day time (0700 – 2300 hrs)		Night Time (2300 – 0700 hrs)		
$L_{Aeq,5min}$	$L_{A90,5min}$	$L_{Aeq,5min}$	$L_{A90,5min}$	L_{Amax}
51 – 68 dB	47 – 56 dB	42 – 66 dB	41 – 59 dB	47 – 86 dB

4.0 Impact of existing noise levels on proposed residential

- 4.1 To determine the impact of existing noise levels from road traffic noise on the proposed residential apartments SR has used the survey data measured at ML1 and ML2.
- 4.2 As detailed in section 3.0 above as there was no secure location to carry out long term unattended noise measurements, the survey was carried out in accordance with the shortened measurement procedure within the Calculation of Road Traffic Noise (CRTN) as shown below:

The $L_{A10,18hr}$ noise level is calculated as:

$$L_{A10,18hr} = \text{Average } L_{A10} (\text{over 3 hours}) - 1 \text{ dB}$$

This can then be corrected to provide a 16 hour L_{Aeq} as per the guidance in BS 8233 by using the calculation below:

$$L_{Aeq16hr} = L_{A10(18hr)} - 2 \text{ dB}$$

- 4.3 The night time noise level, L_{Aeq8hr} were estimated from the measures L_{Aeq} results recorded over the assumed loudest 4 hours of the night time period, between 2300 and 0100 hours and 0500 and 0700 hours. Maximum noise levels were noted from passing traffic during the survey.
- 4.4 On this basis the free-field calculated noise levels at each location are as shown in Table 9 below:

TABLE 9: Calculated Noise Levels

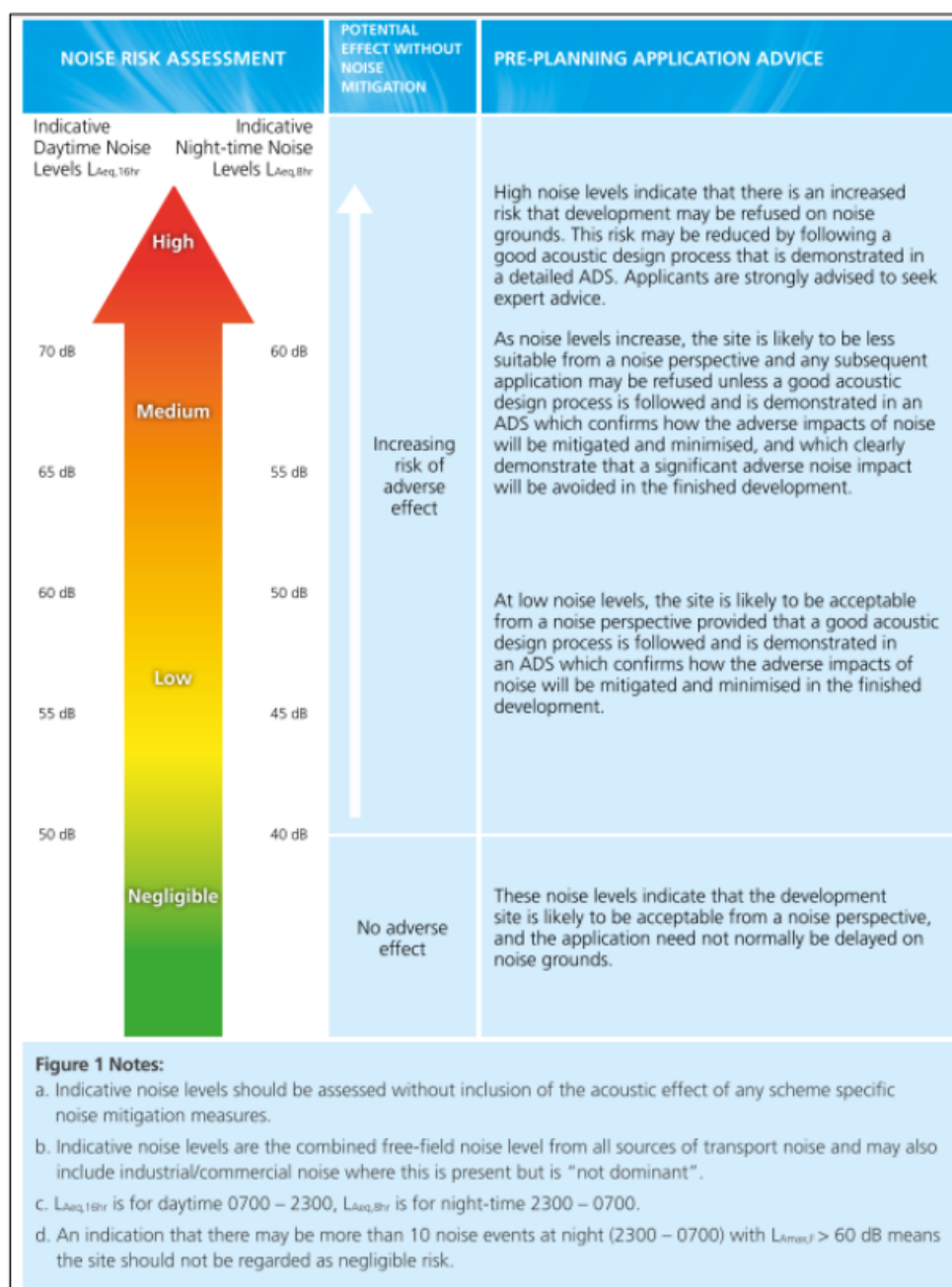
Location	Day time (0700 – 2300 hrs)	Night time (2300 – 0700 hrs)	
	$L_{Aeq16hr}$	L_{Aeq8hr}	L_{Amax}
ML 1	69 dB	65 dB	79 dB
ML 2	61 dB	55 dB	71 dB

Initial Site Noise Risk Assessment

- 4.5 Based on the guidance in the ProPG, as shown in Figure 3 below, the measured noise levels there is a medium/high risk of planning permission being refused on the noise impact on the residential development.
- 4.6 The ProPG advises states that for medium/high risk sites

“as noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.”

FIGURE 3: ProPG – Initial Site Assessment Guidance



London Borough of Hillingdon – Supplementary Planning Guidance – Noise

- 4.7 Based on the local design guidance contained within the Supplementary Planning Guidance on noise the site would be NEC C. For sites in NEC C the advice is as follows:

“Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise to meet the Council’s recommended outdoor and indoor noise levels.”

- 4.8 The conflict between pressure for good housing sites under current guidance on the re-use of previously developed land in sustainable locations and that of PPG 24 on noise is inevitable and residential developments in NEC C, or even D is becoming more common. There has to be some flexibility in the approach to developments such as this and the Noise Exposure Category outside the buildings has become less important given the availability of technically advanced measures to control noise to acceptable levels inside buildings.
- 4.9 As discussed in section 2.0 of the report any assessment of transportation noise on a residential development should cover four main elements as follows:
- Element 1 – demonstrating a “Good Acoustic Design Process”
 - Element 2 – observing internal “Noise Level Guidelines”
 - Element 3 – Undertaking an “External Amenity Area Noise Assessment”
 - Element 4 – Consideration of “Other Relevant Issues”

Element 1 - Good Acoustic Design Process

- 4.10 Generally, there is a hierarchy of noise control that should be considered in all cases, and the layout should demonstrate that the following logical process, which would represent good design, has been followed as far as possible:
- Maximise the spatial separation of noise source(s) and receptor(s);
 - Using existing topography and existing structures to screen the proposed development site from significant sources of noise;
 - Incorporating noise barriers as part of the scheme to screen the proposed site from significant sources of noise;
 - Using the layout of the scheme to reduce noise propagation across the site;
 - Using the orientation of buildings to reduce the noise exposure of noise sensitive rooms;
 - Using the building envelope to mitigate noise to acceptable levels.
- 4.11 The advice in ProPG acknowledges that where noise-sensitive developments are proposed in noisy locations there is a limit to the extent to which good acoustic design can be achieved and that it may not always be possible to achieve acoustic standards with windows open or accepting that noise levels in parts of the outdoor amenity areas may not be optimal. In such cases suitable living conditions, in line with the guidance in BS 8233:2014, can still be achieved by using the building envelope to control noise levels.
- 4.12 In terms of noise the location of the site restricts the opportunities to reduce the impact of noise through maximising the separation between noise source and receptors and acoustic screens. Notwithstanding the constraints on the site the development the following good acoustic design measures have been included in the site:

- The development has been designed around a central amenity deck on the first floor. This area will be screened from all noise sources by the proposed development to provide a quiet external area for residents.

Element 2 – Internal Noise Level Guidelines

- 4.13 Comparison with the criteria in BS 8233:2014 suggests that in order to reduce internal noise levels to 35 dB $L_{Aeq16hr}$ during the daytime (living rooms and bedrooms) and 30 dB L_{Aeq8hr} and 45 dB L_{Amax} during the night time period (bedrooms), this would require an inside to outside overall reduction of 35 dB for rooms on the southern, eastern and northern façade (marked in green in Figure 4 below) and 26 dB for all rooms (marked in orange) on the south western façade.

Figure 4: Façade treatments



- 4.14 Glazing is often specified using a R_w value which would typically be around 6 dB¹ higher than the outside to inside noise levels reductions quoted. Therefore the glazing requirements will be in the region of $R_w = 41$ dB for windows marked in green below and 32 dB for those marked in Orange. This performance can be achieved by using acoustic glazing systems as shown below:

System I (Green):

10mm glass – 12mm air gap – 8mm(laminated glass)

System II (Orange)

4mm glass – 12mm air gap – 6mm glass

For all other facades thermal double glazing which will be sufficient.

- 4.15 Based on the noise levels measured outside, for properties with facades marked orange and green to achieve internal noise levels in line with the criteria within BS 8233:2014 background ventilation will be provided by MVHR units which will enable internal noise levels to be achieved with windows closed.

¹ This is a typical value, detailed calculations will take into account room and glazed area dimensions. This report must not be used for detailed design or procurement purposes.

- 4.16 It is recommended that detailed sound insulation calculations are undertaken at the appropriate detailed design stage to ensure that internal noise levels for all residential units with the proposed development comply with the internal noise levels contained within BS 8233:2014. This work could be secured by imposition of a suitably worded planning condition as follows:

“A scheme of sound insulation for the proposed residential development shall be submitted to the local planning authority and approved in writing. The recommendations within the sound insulation report shall be implemented in full prior to the first occupation of the residential units.”

Element 3 – External Amenity

- 4.17 For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 55 dB $L_{Aeq16hr}$.
- 4.18 As discussed in para 4.12 the site has been designed around a central amenity area which will be screened from existing noise in the area by the building. This will provide a relatively quiet private amenity external area for exclusive use by residents to relax and enjoy in line with the guidance contained within Planning Practice Guidance on Noise.

Element 4 – Assessment of other relevant issues

- 4.19 The fourth and final element of Stage 2 is an assessment of other relevant issues, including compliance with relevant national and local policy; the magnitude and extent of compliance with ProPG; likely occupants of the development; unintended adverse consequences resulting from the acoustic design and wider planning objectives.

Compliance with national policy

- 4.20 In terms of noise sensitive development the main aims of the NPPF is the avoidance of significant adverse effects and the mitigation and reduction of any adverse impacts to a minimum. As discussed in section 2.0 of this report, the current nationally recommended internal noise levels for dwellings are given in BS 8233:2014 'Guidance on Sound Insulation & Noise Reduction for Buildings.' These guideline values are based on the WHO Guidelines for Community Health which was released in a final form in 2000. The World Health Organisation guidance is referenced in the NPSE.
- 4.21 The WHO guideline values are appropriate to what are termed “critical health effects”. This means that the limits are at the lowest noise level that would result in any psychological, physiological or sociological effect. They are, as defined by NPSE, set at the Lowest Observed Adverse Effect Level (LOAEL), therefore compliance with the guideline values will ensure that existing noise levels do not cause significant adverse impact to future residents.
- 4.22 As shown above as a result of good acoustic design measures the site, both internal and external noise levels will comply with the guidance in BS 8233:2014 and the WHO Guidelines. Therefore it is concluded that the proposed development complies with the policy aims contained within the NPPF.

Compliance with ProPG

- 4.23 The main aim of the ProPG guidance is the inclusion of good acoustic design measures to reduce the need for windows to achieve internal noise levels. However it is recognised in the guidance that for development in built up areas it may not always be possible to achieve acoustic standards with windows open as in this case. Notwithstanding the site has been designed with good acoustic principles in mind to ensure that the main external area comply with the guidelines for outdoor amenity spaces.

Likely occupant of the development

- 4.24 With regard to the likely occupants of the development new residents are likely to choose the site based on its location as such they would reasonably expect a certain level of noise from street activity.

Unintended adverse consequences

- 4.25 To ensure that internal noise levels in bedroom during the night comply with the guidance contained in BS 8233:2014/WHO Guidelines for the facades marked in orange and green in Figure 4 above it will be necessary to have windows closed. Background ventilation, to comply with Building Regulations Part F, will be provided to these rooms by an attenuated MVHR system. For these rooms it is likely that during hot weather likely windows will be open however it is recognised that during these short periods residents will accept higher internal noise levels.

5.0 Impact of development on existing and proposed residential properties

5.1 As part of the development the existing Morrisons supermarket will be demolished and replaced with a new store, with an enclosed delivery area and basement parking. The main impacts of noise from the store will be as follows:

- Noise from mechanical services plant;
- Noise from delivery activity;
- Noise from shop floor activity.

Mechanical Services Plant

- 5.2 The redevelopment of the site will involve the installation of new mechanical services plant including, refrigeration and condenser units, air handling units, extract fans, boilers, and stand-by generators in an enclosed plant area on the northern side of the store.
- 5.3 The exact type and its associated noise characteristics will depend on the end-user of the units and is yet to be determined. It would therefore be appropriate to impose a planning condition to control noise output from the plant serving the propose store.
- 5.4 The objective assessment of plant sound sources in commercial premises should be undertaken in accordance with British Standard 4142:2014. This Standard enables the resultant sound levels from new plant equipment to be compared against the existing background sound level (LA90) of an area to assess the impact.
- 5.5 In terms of seeking to set appropriate plant rating sound limits, the advice in BS 4142:2014 is that *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source of having a low impact, depending on the context"* (clause 11, note 'd').
- 5.6 Based on survey data at ML3 the lowest daytime and night time background noise levels during the survey were 47 dB during the day time and 41 dB during the night time. In relation to industrial type noise source the advice in the London Borough of Hillingdon SPD on noise, is that based on the assessment in BS 4142:1997, the rating level of noise should be at least 5 dB below the background noise level.
- 5.7 Although the 1997 version of the standard has now been replaced it is assumed that a similar approach would apply in this case. This would lead to a plant rating level sound level of 42 dB during the day (0700 – 2300 hours) and 36 dB during at night.
- 5.8 The following planning condition is recommended to secure the above criteria:

"No fixed plant and/or machinery shall come into operation until details of the fixed plant and machinery serving the development hereby permitted, and any mitigation measures to achieve this condition, are submitted to and approved in writing by the local planning authority. The rating level of the sound emitted from the site shall not exceed 42 dBA between 0700 and 2300 hours and 36 dB during 2300 and 0700 hours. The sound levels shall be determined by measurement or calculation at the nearest noise sensitive premises. The measurements and assessment shall be made according to BS 4142:2014."

- 5.9 The above condition would apply to existing noise sensitive properties and also the residential units within the development.
- 5.10 In addition to the plant area it is likely that a ventilation system will be required to remove exhaust fumes from the basement car parks and the enclosed service yard, although the precise requirements with regard to ventilation have yet to be determined at this stage. It is suggested that a scheme for protecting both existing and new dwellings from ventilation noise can be agreed with the Local Authority and secured by way of a similar planning condition to that above.
- 5.11 For plant such as standby generator and smoke extract fans the above criteria can be relaxed as they will only be used in emergency situations. In such cases it is not uncommon to have criteria of 5dB above background noise levels i.e. 52 dBA during the day and 46 dB during the night time period. Any testing of such plant should be restricted to day time hours only.

Noise from delivery activity

- 5.12 The proposed loading bay will be accessed and located in a similar position to the service yard at the existing store, however unlike the existing service yard, which is open, the proposed yard will be fully enclosed. In terms of the impact to existing residential properties this will significantly reduce the impact of delivery activity.
- 5.13 The main impact from delivery activity will therefore be on the proposed residential units above and adjacent to the service area.
- 5.14 To prevent noise, both airborne and structure borne noise from delivery activity affecting future residents it will be necessary to give consideration to noise break out from the service area.
- 5.15 Of main concern will be peak noise levels, L_{Amax} , from goods being unloaded. To ensure noise from delivery activity does not cause adverse impact to residents of the apartments it is recommended that internal noise levels from delivery activity within the flats do not exceed 35 dB L_{Amax} . This is significantly below the suggested criteria in BS 8233:2014.
- 5.16 To achieve the above noise criteria it will necessary to reduce the transmission of sound through the structure this can be achieved by increasing the mass of intervening walls and floors and/or the use of a floating concrete floor on vibration isolation springs/mounts to reduce transmission of noise through the structure of the building. The above works can be secured by a planning condition as shown below:

'A scheme of sound insulation between the enclosed service yard and the proposed residential properties to ensure that maximum noise levels from activity at retail foodstore do not exceed 35 dB L_{Amax} shall be submitted to the local planning authority and approved in writing. The recommendations within the sound insulation report shall be implemented in full prior to the first occupation of the residential units.'

Noise from shop-floor activity

- 5.17 Similar to the delivery area it will be necessary to ensure that internal noise from shop floor activity does not cause adverse impact to the residents above. The suggested noise criteria and condition above can also be applied in this case.

6.0 Summary and Conclusions

- 6.1 Sharps Redmore has undertaken an environmental noise assessment of the proposed redevelopment of the existing Morrisons supermarket at 43 – 67 High Street, Yiewlsey to provide a replacement Morrisons foodstore, with 144 residential units above.
- 6.2 The objective of the assessment is to determine the following:
- Impact of existing noise on the proposed residential properties;
 - Impact of proposed ground floor commercial use on existing and proposed residential properties.
- 6.3 Noise assessment criteria were selected by reference to relevant government and international guidance documents.

Noise impact of road traffic on proposed residential properties

- 6.4 The impact of road traffic noise has been assessed in accordance with BS 8233:2014 and the Professional Practice Guidance ProPG Planning and Noise for new residential developments.
- 6.5 Taking into account the good acoustic design measures the site can be developed to ensure reasonable internal and external noise levels which comply with the requirements of BS 8233:2014.
- 6.6 This assessment concludes that noise from existing sources would not cause significant disturbance to proposed future residents, and is therefore in accordance with the policy aims of National Planning Policy Framework.

Noise impact from development on existing and proposed residential properties

- 6.7 Unlike the existing arrangements the proposed store will be served by a fully enclosed delivery area which will reduce the noise impact from delivery activity on existing residential properties.
- 6.8 Planning conditions have been recommended to control noise from any mechanical services use and noise break-out from delivery area and shop floor.
- 6.9 Subject to the suggested planning conditions noise from the proposed food store will not cause impact to existing and future residents in line accordance with the policy aims of the National Planning Policy Framework.

APPENDIX A

ACOUSTIC TERMINOLOGY

Appendix A: Guide to Acoustic Terminology

Ambient noise:

The totally encompassing sound in a given situation at a given time. Most often described in terms of the index L_{AeqT} .

Atmospheric absorption:

The excess acoustic attenuation, over and above that caused by distance attenuation, due to the interaction of an acoustic wave with air molecules.

A-weighting:

A frequency weighting which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Units may be denoted as dB(A) or as sound pressure levels L_{pA} in dB. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound.

Background noise:

See L_{A90} .

Correction (for characteristic features of noise source):

A 5 dB penalty applied to the specific noise level if the noise being assessed “contains a distinguishable, discrete continuous note”, contains “distinct impulses”, or is “irregular enough to attract attention” (ref BS 4142:1997).

Decibel (dB):

A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μ Pa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

Façade noise level:

The noise level adjacent to the façade of a building, usually at a distance of 1 metre.

Free-field noise level:

The noise level away from the façade of a building or other structure.

Hertz (Hz):

Unit of frequency, equal to one cycle per second. Frequency is related to the pitch of a sound.

L_{A10T} : The A weighted level of noise exceeded for 10% of the specified measurement period, T. It gives an indication of the upper limit of fluctuating noise such as that

from road traffic. $L_{A10,18hr}$ is the arithmetic average of the 18 hourly $L_{A10,1hr}$ values from 0600 hrs to 2400 hrs.

L_{A90T} : The A weighted noise level exceeded for 90% of the specified time period, T. In BS 4142:1997 it is used to define background noise level.

L_{AeqT} : The equivalent continuous sound level - the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period, T. This period is taken to be 16 hours (0700 hrs to 2300 hrs) and 8 hours (2300 to 0700 hrs) to describe day and night, in PPG 24 L_{AeqT} is used to describe many types of noise and can be measured directly with an integrating sound level meter.

SEL or L_{AE} : The sound exposure level is the A-weighted sound energy produced by a discrete noise event averaged over one second, no matter how long the event actually took. This allows for comparisons to be made between different noise events which occur for different lengths of time.

APPENDIX B

NOISE SURVEY RESULTS

Appendix B: Survey Results ML3

Date	L _{Aeq}	L _{Af(max)}	L _{Af(min)}	L _{Af(10)}	L _{Af(90)}
(2018/04/16 14:20:00.00)	62.6	82.9	49.2	63.4	52.1
(2018/04/16 14:25:00.00)	58.8	74.7	50.4	61.8	53
(2018/04/16 14:30:00.00)	58.7	72.4	51.1	61.2	53.5
(2018/04/16 14:35:00.00)	57.9	66.7	49.9	61.3	52.6
(2018/04/16 14:40:00.00)	56.2	65.9	48.4	60	51.4
(2018/04/16 14:45:00.00)	58.7	71.8	49.2	61.8	51.5
(2018/04/16 14:50:00.00)	60.2	76.4	50.1	62.6	52.9
(2018/04/16 14:54:59.00)	57.9	71.2	49.4	60.7	51.7
(2018/04/16 15:00:00.00)	57.5	69.4	50	61.3	51.7
(2018/04/16 15:05:00.00)	56.4	70.5	50.8	59.5	52.1
(2018/04/16 15:10:00.00)	58.8	71.7	50.3	62.2	51.9
(2018/04/16 15:15:00.00)	57.5	70.1	49.5	61.6	50.9
(2018/04/16 15:20:00.00)	57	71.8	49.7	59.6	52.1
(2018/04/16 15:25:00.00)	57.6	75.2	50.5	61.1	52
(2018/04/16 15:30:00.00)	58.7	73.9	50.2	61.1	51.9
(2018/04/16 15:34:59.00)	56.5	68.4	49.3	60.2	50.8
(2018/04/16 15:40:00.00)	58.1	69	48.8	61.8	50.6
(2018/04/16 15:45:00.00)	56.8	67.7	49.1	60.5	50.4
(2018/04/16 15:50:00.00)	53.6	65.4	48.3	56.9	49.5
(2018/04/16 15:55:00.00)	64.1	77.8	48.7	70.7	50.8
(2018/04/16 16:00:00.00)	65.8	82.1	51.2	68.2	55.7
(2018/04/16 16:05:00.00)	60.2	71.3	47.6	63.8	50.6
(2018/04/16 16:10:00.00)	56.8	69.2	48	60.5	50.3
(2018/04/16 16:15:00.00)	55.7	69.8	48.4	58.6	50.3
(2018/04/16 16:20:00.00)	56.2	70.3	49.1	59.3	51.1
(2018/04/16 16:25:00.00)	56.7	72.1	49	60.5	51.3
(2018/04/16 16:30:00.00)	58.1	73.7	48	60.6	50.5
(2018/04/16 16:34:59.00)	55.5	72.3	48.4	58.4	50.6
(2018/04/16 16:39:59.00)	56.5	70.1	48.4	59.3	50.4
(2018/04/16 16:45:00.00)	57.3	69.7	47.8	60.4	50
(2018/04/16 16:50:00.00)	57	70.8	48.8	59.7	50.6
(2018/04/16 16:55:00.00)	54.7	67.1	47.7	57.1	50
(2018/04/16 17:00:00.00)	56.5	69.9	48.4	60	50.3
(2018/04/16 17:05:00.00)	56.8	72.9	47.7	59.5	49.7
(2018/04/16 17:10:00.00)	61.6	78.2	49.1	64.5	50.9
(2018/04/16 17:15:00.00)	56.1	66.1	48.2	59.8	50
(2018/04/16 17:20:00.00)	57	68.9	49.1	61.4	50.6
(2018/04/16 17:25:00.00)	56.4	68	49	60.2	51.2
(2018/04/16 17:30:00.00)	57.4	68	51.3	60.3	52.9
(2018/04/16 17:35:00.00)	58.6	73.2	51.9	60.8	53.7
(2018/04/16 17:40:00.00)	59.5	74	52.3	61.8	54.6
(2018/04/16 17:45:00.00)	59.8	69.1	52.2	62.1	55.8
(2018/04/16 17:50:00.00)	59.5	82.7	50.2	59.5	52.8
(2018/04/16 17:55:00.00)	58.2	70.2	49.7	61.6	51.4

(2018/04/16 18:00:00.00)	56.2	72.5	48.3	59.4	49.8
(2018/04/16 18:04:59.00)	60.9	82.7	49.1	59.4	50.9
(2018/04/16 18:10:00.00)	55.6	70.1	48.8	58.8	50.3
(2018/04/16 18:15:00.00)	58.6	72.7	48.8	62.5	50.7
(2018/04/16 18:20:00.00)	54.2	64.1	47.9	57.4	49.8
(2018/04/16 18:25:00.00)	56.1	67.6	49	59.6	50.7
(2018/04/16 18:30:00.00)	57.5	72.6	49.2	60.8	50.7
(2018/04/16 18:35:00.00)	55.7	69	49.2	59.3	51.1
(2018/04/16 18:39:59.00)	56.5	70	48.8	59.2	50.2
(2018/04/16 18:45:00.00)	57.1	75.6	48.3	58.8	49.8
(2018/04/16 18:50:00.00)	54.4	65.6	48.2	58.1	49.4
(2018/04/16 18:54:59.00)	58.5	70.7	51	61.3	52.1
(2018/04/16 19:00:00.00)	56.5	71	50.7	59.2	52.3
(2018/04/16 19:05:00.00)	56	67.8	51.6	58.7	52.7
(2018/04/16 19:10:00.00)	56.4	66.1	51.9	59.5	52.9
(2018/04/16 19:15:00.00)	56.3	66.4	51.7	59.3	52.8
(2018/04/16 19:19:59.00)	58.4	71.5	51.7	62	52.9
(2018/04/16 19:25:00.00)	55.8	67.5	51.3	57.7	52.3
(2018/04/16 19:30:00.00)	58.7	72.2	51.4	61.3	53
(2018/04/16 19:35:00.00)	57.7	72.2	50.6	59.7	52.1
(2018/04/16 19:39:59.00)	57.6	72.5	50.5	60.2	51.9
(2018/04/16 19:45:00.00)	55.4	68	51.4	57.6	52.6
(2018/04/16 19:50:00.00)	56.5	68.7	51.4	59.5	52.5
(2018/04/16 19:55:00.00)	57.3	70.7	50.8	60.7	52
(2018/04/16 20:00:00.00)	56.1	71.6	50.7	58.6	51.9
(2018/04/16 20:05:00.00)	56	71.1	50.3	58.6	51.4
(2018/04/16 20:09:59.00)	57.4	72.1	48.4	60.3	50.4
(2018/04/16 20:14:59.00)	56.7	74.6	47.8	58.7	49.8
(2018/04/16 20:20:00.00)	55.6	70.2	47.3	58.9	49.1
(2018/04/16 20:25:00.00)	53.3	67.2	46.4	55.9	47.8
(2018/04/16 20:30:00.00)	55.4	71	46.1	58.1	47.9
(2018/04/16 20:35:00.00)	51.8	63	46.3	54	48
(2018/04/16 20:40:00.00)	54.8	70	46.8	57.5	48.1
(2018/04/16 20:45:00.00)	54	69.3	45.8	56.9	47.6
(2018/04/16 20:50:00.00)	50.8	62.4	45.3	52.8	46.7
(2018/04/16 20:55:00.00)	52.6	73.2	45.5	55.5	47.8
(2018/04/16 20:59:59.00)	55.9	82.4	46.5	56.6	47.9
(2018/04/16 21:05:00.00)	50.9	61.8	45.5	54.2	46.5
(2018/04/16 21:10:00.00)	53.5	68.8	45.5	56.4	47.5
(2018/04/16 21:15:00.00)	53.1	66.9	46.3	55	48.1
(2018/04/16 21:20:00.00)	53.5	68	46.2	56.2	47.9
(2018/04/16 21:25:00.00)	52.6	68.1	47.2	54.1	48.5
(2018/04/16 21:30:00.00)	53.5	67.8	46.3	56.2	48.1
(2018/04/16 21:34:59.00)	52.8	70.4	47.2	53	48.4
(2018/04/16 21:40:00.00)	53.9	66.2	47.6	56.4	48.8
(2018/04/16 21:45:00.00)	54.6	67.3	47.3	57.9	49.1

(2018/04/16 21:49:59.00)	53.8	66.6	47.4	56.2	48.7
(2018/04/16 21:55:00.00)	54.2	64.9	47.4	56.8	49.2
(2018/04/16 22:00:00.00)	54.2	64.4	47.4	57.3	49.2
(2018/04/16 22:05:00.00)	54.2	65.2	48.1	56.8	50.5
(2018/04/16 22:10:00.00)	53.5	63.1	48.2	56.2	50.2
(2018/04/16 22:15:00.00)	55.4	71.5	47.7	57.1	49.7
(2018/04/16 22:20:00.00)	54	66.3	46.6	57.6	48.3
(2018/04/16 22:25:00.00)	50.8	61.4	46.2	52.8	47.4
(2018/04/16 22:30:00.00)	52.7	62.3	47.1	55.3	48.9
(2018/04/16 22:35:00.00)	55.3	65.2	48.5	58.6	50.3
(2018/04/16 22:40:00.00)	55.1	70.2	47.8	57.4	49.6
(2018/04/16 22:45:00.00)	55	69.9	47.5	58.4	49.2
(2018/04/16 22:50:00.00)	52.3	64.1	46.3	55.2	47.9
(2018/04/16 22:55:00.00)	53.3	66.1	46.2	56	48.1
(2018/04/16 23:00:00.00)	52.3	67.5	45.6	54.5	46.8
(2018/04/16 23:05:00.00)	47.4	51.2	44.8	48.8	45.9
(2018/04/16 23:09:59.00)	48.9	59.3	44	51.7	45.6
(2018/04/16 23:15:00.00)	49.7	61	43.1	53.7	44.7
(2018/04/16 23:19:59.00)	45.9	54.5	42.9	47	44.1
(2018/04/16 23:24:59.00)	46.7	62.8	43.2	48.4	44.6
(2018/04/16 23:29:59.00)	46.7	52.1	43.6	49	44.5
(2018/04/16 23:35:00.00)	48.8	66.1	43	49	44.5
(2018/04/16 23:40:00.00)	46.7	56.5	42.8	48.7	44.1
(2018/04/16 23:45:00.00)	45.8	61.3	42.7	47.2	43.7
(2018/04/16 23:49:59.00)	45.2	58.1	42.5	46.3	43.7
(2018/04/16 23:54:59.00)	45.9	53.1	42.4	48.2	43.5
(2018/04/17 00:00:00.00)	44.6	52	42	46	43
(2018/04/17 00:05:00.00)	47.3	64.6	41.8	46.9	43.1
(2018/04/17 00:10:00.00)	45.1	51.5	41.9	46.9	43.2
(2018/04/17 00:15:00.00)	44.1	50.9	41.7	45.6	42.7
(2018/04/17 00:20:00.00)	44.4	52.6	41.8	45.8	42.9
(2018/04/17 00:25:00.00)	51.2	70.2	41.3	49	42.6
(2018/04/17 00:30:00.00)	43.7	50	40.9	45.4	41.9
(2018/04/17 00:34:59.00)	44.6	57.1	40.7	47.2	41.7
(2018/04/17 00:40:00.00)	44.3	51.3	40.6	47.8	41.6
(2018/04/17 00:45:00.00)	48.6	73.6	40.8	47.3	41.8
(2018/04/17 00:50:00.00)	43.7	63.3	40.7	44.5	41.7
(2018/04/17 00:55:00.00)	42.4	54.9	39.8	43.5	41.1
(2018/04/17 01:00:00.00)	44.7	56.8	40.9	46.2	42.3
(2018/04/17 01:04:59.00)	42.8	49.8	40.3	44.1	41.4
(2018/04/17 01:10:00.00)	43.4	55.2	40.3	44.9	41.5
(2018/04/17 01:15:00.00)	42.4	49.7	40.1	43.5	41.2
(2018/04/17 01:19:59.00)	41.7	47	39.8	42.4	41
(2018/04/17 01:25:00.00)	42.7	49.8	40.5	43.7	41.5
(2018/04/17 01:30:00.00)	43.3	54	41.1	44.4	42
(2018/04/17 01:35:00.00)	43.3	51.9	41.2	44.3	42.2

(2018/04/17 01:40:00.00)	50.6	70.3	41.4	50.6	42.2
(2018/04/17 01:45:00.00)	43	48.9	40.9	44.2	41.8
(2018/04/17 01:50:00.00)	43.5	52.2	40.9	45.2	41.9
(2018/04/17 01:55:00.00)	44.2	52.1	41.3	46.7	42.2
(2018/04/17 02:00:00.00)	48.2	58	41.1	53.3	42.2
(2018/04/17 02:05:00.00)	43.2	51.2	40.4	44.8	41.6
(2018/04/17 02:10:00.00)	49.3	72.7	40.9	49.5	41.8
(2018/04/17 02:15:00.00)	43.1	53.3	41.2	43.8	42.1
(2018/04/17 02:20:00.00)	43.1	57.2	40.7	43.9	41.6
(2018/04/17 02:25:00.00)	43.4	57.5	41.1	44.4	42.2
(2018/04/17 02:30:00.00)	43.4	53.9	40.6	44.7	41.7
(2018/04/17 02:34:59.00)	44.2	52.7	40.8	46.1	42
(2018/04/17 02:40:00.00)	42.8	48.8	40.4	43.8	41.6
(2018/04/17 02:45:00.00)	43.3	49.9	41.2	44.4	42.2
(2018/04/17 02:50:00.00)	45	57.6	41.8	47.1	42.9
(2018/04/17 02:55:00.00)	44	56.1	41.8	45	42.8
(2018/04/17 03:00:00.00)	44.6	55.5	41.2	46.2	42.5
(2018/04/17 03:05:00.00)	46	57.6	41.4	48.1	42.6
(2018/04/17 03:10:00.00)	49.6	69.2	41.2	47.3	42.4
(2018/04/17 03:15:00.00)	44	53.5	40.7	45.8	42
(2018/04/17 03:20:00.00)	43.7	55.4	41	45.2	42.2
(2018/04/17 03:25:00.00)	44.2	58.1	41.3	45.8	42.5
(2018/04/17 03:29:59.00)	49	58.7	41.4	53.3	42.8
(2018/04/17 03:34:59.00)	44	53.5	41	45.6	42.3
(2018/04/17 03:39:59.00)	44	60.8	41.2	45.5	42.1
(2018/04/17 03:45:00.00)	44.2	51.2	41.1	45.9	42.3
(2018/04/17 03:50:00.00)	44.1	54.2	41.5	45.6	42.5
(2018/04/17 03:54:59.00)	47.7	60.2	41.9	49.6	44.2
(2018/04/17 03:59:59.00)	44.2	49.9	41.5	45.6	42.8
(2018/04/17 04:04:59.00)	44.3	51.2	41.7	46.1	42.8
(2018/04/17 04:10:00.00)	46.8	63.8	41.5	48.5	43
(2018/04/17 04:15:00.00)	45.2	50.4	43	46.6	43.9
(2018/04/17 04:20:00.00)	47.1	62.1	43.2	50.3	44.3
(2018/04/17 04:25:00.00)	46.7	55.5	43.1	49.5	44
(2018/04/17 04:30:00.00)	48.3	56.3	43.4	51.7	44.8
(2018/04/17 04:35:00.00)	48.8	57.2	43.9	51.4	45
(2018/04/17 04:40:00.00)	49.5	56.7	44.1	52.1	46.1
(2018/04/17 04:45:00.00)	49.4	57.3	43.9	51.9	45.9
(2018/04/17 04:50:00.00)	50.6	58.2	44.3	53.4	46.5
(2018/04/17 04:55:00.00)	51.2	61.3	44.4	53.6	46.9
(2018/04/17 05:00:00.00)	50.4	57.5	44.3	52.8	46.3
(2018/04/17 05:04:59.00)	51	57.1	45.4	53.1	47.7
(2018/04/17 05:10:00.00)	52.9	68.5	46.2	54.2	48.4
(2018/04/17 05:15:00.00)	53.8	70.2	46.3	55.8	47.8
(2018/04/17 05:20:00.00)	53.4	62	46.9	56	49.3
(2018/04/17 05:25:00.00)	55.5	67.8	47.3	59.1	49.3

(2018/04/17 05:30:00.00)	55.9	68.7	46.9	60.2	49.4
(2018/04/17 05:34:59.00)	55.8	70.2	46.9	59.5	48.6
(2018/04/17 05:40:00.00)	51	62.7	47.4	52.2	48.9
(2018/04/17 05:45:00.00)	52.9	64.9	48.3	54	49.5
(2018/04/17 05:50:00.00)	53.1	75.7	48.2	53.4	49.5
(2018/04/17 05:55:00.00)	52	60.2	48.5	53.3	50.1
(2018/04/17 06:00:00.00)	53.5	64.8	48.9	56.1	50.2
(2018/04/17 06:04:59.00)	52.5	58.6	49.8	53.8	50.9
(2018/04/17 06:10:00.00)	54.1	70.2	50.1	54.1	51.3
(2018/04/17 06:15:00.00)	55.6	71.9	49.9	56.6	51.5
(2018/04/17 06:20:00.00)	55.7	67.6	50.2	58.3	51.6
(2018/04/17 06:25:00.00)	56.6	68.7	49.5	60	51.1
(2018/04/17 06:30:00.00)	60.2	73.9	49.5	64.2	51.4
(2018/04/17 06:35:00.00)	56.9	73	50.1	59.2	51.5
(2018/04/17 06:39:59.00)	66.3	85.7	53.9	66.9	57.5
(2018/04/17 06:45:00.00)	62.6	74.5	57.4	65.1	59.2
(2018/04/17 06:50:00.00)	57.9	78.4	49.4	60.6	50.6
(2018/04/17 06:55:00.00)	57.4	79.1	49.8	59.8	51.3
(2018/04/17 07:00:00.00)	56.5	69	50.4	59	51.7
(2018/04/17 07:05:00.00)	56.8	76.5	50.5	58.4	51.8
(2018/04/17 07:10:00.00)	55.5	70.1	50.8	57.7	51.9
(2018/04/17 07:14:59.00)	57.2	74.2	50.9	59.1	52.2
(2018/04/17 07:20:00.00)	54.7	66.2	50.6	56.5	51.7
(2018/04/17 07:25:00.00)	54.7	67.6	50.9	56.7	52.3
(2018/04/17 07:29:59.00)	55	71.1	49.8	56.7	51.3
(2018/04/17 07:35:00.00)	68.4	88.9	50.2	71.3	52.1
(2018/04/17 07:40:00.00)	59.2	80.6	50.6	60.1	52.5
(2018/04/17 07:45:00.00)	56.9	70.1	50.6	59.6	52.1
(2018/04/17 07:50:00.00)	64.1	79.7	49.5	67.9	52
(2018/04/17 07:55:00.00)	59.3	80.5	50.7	60.9	52.3
(2018/04/17 08:00:00.00)	59.9	70.7	51	62.8	53.4
(2018/04/17 08:05:00.00)	60.8	70.2	50.6	63.3	54.2
(2018/04/17 08:10:00.00)	60.9	73.6	50.8	63.5	54
(2018/04/17 08:15:00.00)	60.5	74.7	50.5	63	54.9
(2018/04/17 08:20:00.00)	59.6	79.5	49.5	62.3	54.3
(2018/04/17 08:25:00.00)	60.1	72.4	50.3	63.4	53.6
(2018/04/17 08:30:00.00)	61.2	70.4	50.4	63.9	55.8
(2018/04/17 08:35:00.00)	60.5	68.6	51	63.9	54.7
(2018/04/17 08:39:59.00)	60.4	72.8	52	63.1	55.5
(2018/04/17 08:45:00.00)	61.1	76.8	51.7	63.8	53.8
(2018/04/17 08:50:00.00)	60.1	69.5	51.5	63.2	54.4
(2018/04/17 08:55:00.00)	59.1	70.9	51.4	62	54.1
(2018/04/17 09:00:00.00)	59.9	73	50.3	63.3	52.4
(2018/04/17 09:05:00.00)	59.5	74.8	50.3	62.8	52.5
(2018/04/17 09:10:00.00)	60.7	78.2	50.8	63	53.7
(2018/04/17 09:15:00.00)	60.1	85.2	49.9	60.8	51.7

(2018/04/17 09:20:00.00)	57.5	76.3	50.4	59.9	52.1
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