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Reed Global
Dragon Court
27-29 Macklin Street
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NOISE ASSESSMENT

Survey: **Friday 18th September 2015**

Ref: AKS/3397 (22/09/15)

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PhD DIC CEng MSEE MIOA

CONTENTS

CLIENT

REED

(I) LIMIT OF LIABILITY

- This report has been prepared by Civil Engineering Dynamics Ltd, within the scope of our quotation to the client for the project concerned. We accept no responsibility for data presented by other bodies and no legal liability arising from the use of this report by any other party.

(II) SCOPE OF REPORT

- To undertake a noise assessment in relation to plans to deploy Daikin Condenser units at roof level of Reed premises at Dragon Court, 27-29 Macklin Street, London WC2B 5LX.

(III) EXECUTIVE SUMMARY

i. There are plans to deploy four Daikin Condenser units at roof level of Reed premises in London WC2B 5LX, known as Dragon Court. A noise assessment is required to support a planning application for this.

ii. Representative background noise levels were established from a site survey on Friday 18th September 2015.

iii. It is good practise to ensure noise from new plant does not alter the prevailing background level. This can be achieved by ensuring new noise sources do not exceed a level which is 10dB below the representative background level.

iv. The condenser equipment is understood to be operated only during office hours during the weekdays. The relevant background level was therefore established during office hours in a typical weekday.

v. The relevant background noise level can be taken as 48dB in terms of LAF90 metric. This gives a target level of 38 dB which is 10dB below the background, which should not be exceeded by the new equipment at any relevant noise sensitive receptor.

vi. The site neighbourhood comprises office and residential use as well as a school directly opposite.

vii. A review of the neighbouring buildings and estimates of distances from aerial maps, indicate the most sensitive receptor will be the school directly opposite, albeit the more sensitive areas are at lower elevations, which enjoy some natural screening.

viii. This assessment concludes with a recommendation to alter the original planned condenser layout, and the planned visual Louvre screen for an acoustic rated Louvre screen, to also provide noise mitigation.

1. INTRODUCTION

1.1. Reed have renovated their third floor office, and provided additional mechanical services to cope with peak demand in summer and winter, which necessitate the deployment of four condensers. The units are said to run continuously at varying load during daytime office hours from 8am to 6pm. These are planned to be located at roof level adjacent to the existing rooftop plant enclosures at the front elevation, shown indicatively in Plate 1.1.

Plate 1.1 extract from Google Earth

1.2. Civil Engineering Dynamics were commissioned by Davies Vickery Associates acting for Reed, to provide a noise assessment to support the planning application for the works.

1.3. The background noise levels at the site were established from a site survey on Friday 18th September 2015.

1.4. Data sheets from Daikin were studied to provide noise levels from their equipment, which is used in the assessment.

2. MONITORING PROCEDURE

2.1. The noise measurements entailed placing the noise meter on a tripod with microphone at a height of 1.3m, at various locations on the roof level and 3rd floor terrace level, which included a measurement deemed comparable to the background at relevant noise sensitive receptors, which were themselves not directly accessible.

2.2. Fig 2.2 shows a plan at 3rd floor level and the monitoring locations used for sampling the background.

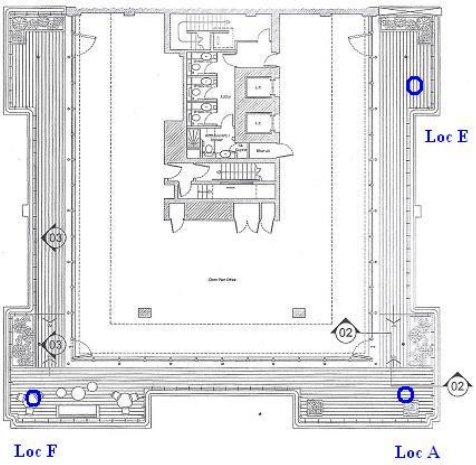
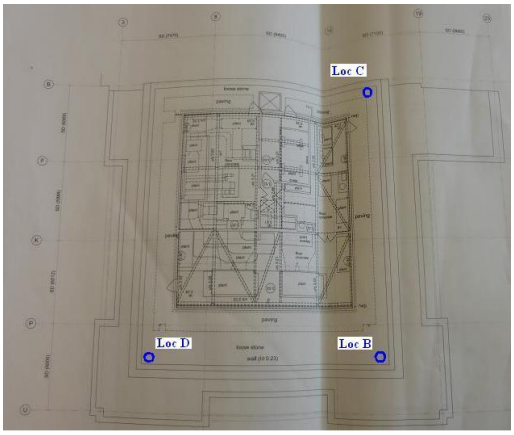
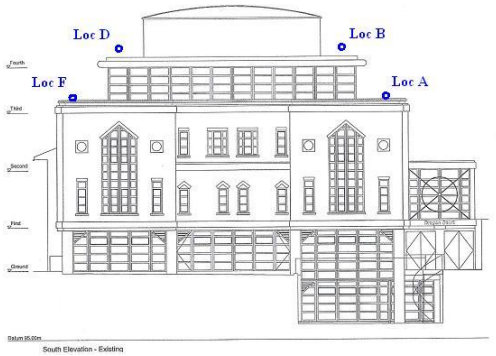


Fig 2.2

2.3. Fig 2.3 shows plant room level, and the measurement sample locations there.



2.4. Fig 2.4 shows a front elevation.



3. INSTRUMENTS

3.1. A Bruel and Kjaer 2250 type 1 noise meter (s/n 2626220) was used for the measurement, along with a B&K 4231 calibrator (s/n 1795486). The noise meter was set to free field response and fitted with a windshield with auto detect for software correction. The meter was calibrated at the start and checked during and at the end of the survey, with no drift. The noise meter is within its 2 year calibration period and the calibrator within its 1 year calibration period, with certificates available upon request.

4. SITE CONDITIONS

4.1. The weather on the day of the test was mixed, overcast, with periods of dry weather interspersed with occasional rain showers. The site is relatively screened by adjoining buildings with a light wind occasionally detectable. The monitoring was stopped and the noise meter was retrieved each time there was an occasional rain shower. Due to some adverse weather on the day of the survey, the noise samples were short 5 minute logs taken sequentially over 15 minutes where possible otherwise at least one clean 5 minute log was obtained at each location. Weather archive from local station within 1km of site is shown in Annex B.

4.2. The equipment within the rooftop plant enclosure was observed to be running. The new condenser units are not yet deployed on site.

4.3. The sound in the area is characterised by distant road traffic, occasional alarms from reversing lorries, sirens, distant aircraft and overhead helicopters, including noise from school children, and bells at the end of break. Some noise from pedestrians talking loudly is also evident. There were occasional sounds from a skip being filled at an adjoining site. The sound break out from the existing plant room did not feature significantly to characterise the environment.

5. RESULTS

5.1. Annex A gives a basic guide to Acoustic Terminology used. The three noise metrics referred to are based upon 5 minute samples, with the L_{Aeq} indicative of a kind of average noise level, whilst the L_{AF90} is indicative of the background noise level, with L_{AFmax} being the maximum noise levels obtained with Fast time response in the measurement period. It is usual to refer to a 1 hour reference period in the daytime, but a shorter reference period of 15 minutes was used due to weather restrictions on the day of the survey.

5.2. A change of 1dB is difficult to discern at a site, although a 3dB change would be noticeable and a change of 10dB would represent a subjective impression that the perceived loudness had halved or doubled.

5.3. Noise levels taken at roof level are influenced by close proximity to the existing plant room enclosure, although have lines of site to ambient sound sources at ground level as the roof level does not have a perimeter wall, although is screened to a degree by the terrace level below. Sound measurements taken at 3rd floor level are screened to a degree from the plant room above although the terrace has a glass perimeter wall at a height of 1.15m, which provides some screening from sound below. Background sound levels on the third floor terrace are lowest at location A. It's location is 3m from the corner of the set back third floor glass facade and so approximates free-field.

5.4. The lowest background sound level at location A is shown in Table 5.4, from which we can use the LAF90, $_{15min}$ metric of 48dBA, and can be conservatively used as the background level. This can be used to set an upper limit for new noise sources that is 10 decibels below this background. These measurements relate to a window of calm weather conditions acceptable for noise measurements.

Table 5.4

Start Time	LASmax	LAeq,$_{5\ min}$	LAF90,$_{5\ min}$
11:54	58	51	48
11:59	59	51	48
12:04	60	52	49
		LAeq, $_{15min}$	LAF90, $_{15min}$
		51	48

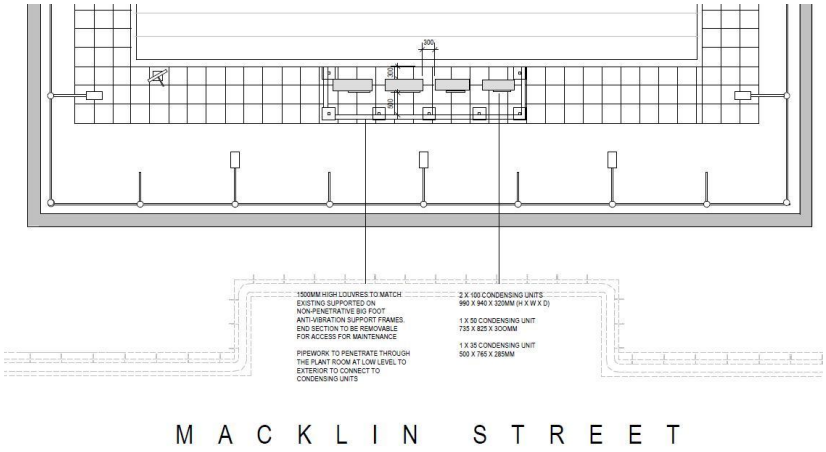
6. ASSESSMENT

6.1. The philosophy of BS 4142, 2014 'Methods for rating and assessing industrial and commercial sound', can be used to compare the specific sound level for the new plant, allowing for adjustments for any characteristics that attract a penalty to arrive at a Rating Level for comparison with the background level in terms of LAF90. The smaller the Rating Level as compared to the background, the less likely there will be a concern for noise, and the previous version of the standard indicated that where the difference is -10dB this is a positive indication that complaints are unlikely, and can be used as the ideal benchmark.

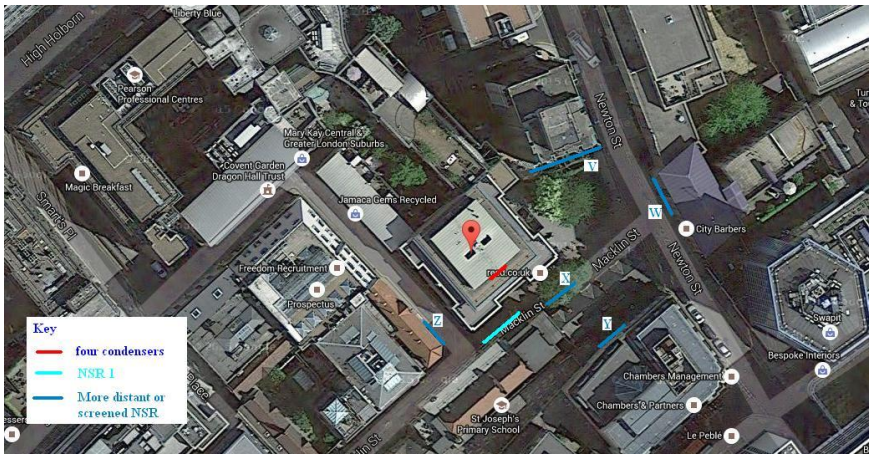
6.2. There are four Daikin condenser units planned for deployment. Noise is created by the condenser located at the bottom of the unit, and a fan deployed at the centre, and a four way valve that activates when switching between cooling and heating mode. The units are said to operate continuously at varying load, and there are said to be no characteristics that could attract a noise penalty. The heating mode can generate stronger levels.

	Unit 1		Unit 2		Unit 3		Unit 4	
Daikin Unit	RZQSG100L8V1		RXS50L		RXS35L3		RZQSG100L8V1	
	cooling	heating	cooling	heating	cooling	heating	cooling	heating
SPL dBA @ 1m	53	57	48	48	48	49	53	57

6.3. The present planned layout is shown in Fig 6.3, along with an open louvre enclosure for visual screening. The assessment has utilised the given orientation of the units, and it is prudent to have the louder RZQSG100L8V1 units on the ends, and the quieter units in between.



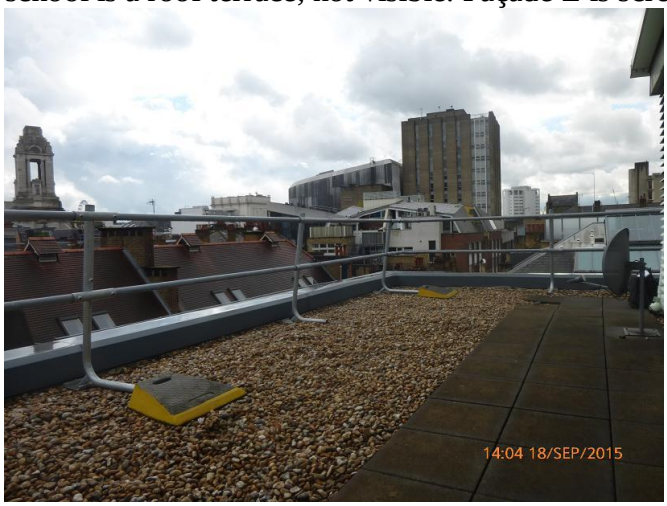
6.4. Plate 6.4 shows an aerial view, indicating Noise Sensitive Receptors. NSR1 is directly opposite the new plant and part of a school façade. The other facades labelled V,W,X,Y and Z are more distant, and in some cases by virtue of lower elevation are well screened from the new proposed plant. An assessment and solution that address the closest façade thereby automatically satisfy these other receptors.



6.5. Plate 6.5 show views towards the noise sensitive facades, from a viewpoint set at a height of 1m on the centre of the footprint of the new plant, so as to give the lines of sight. Facades or areas not in view are therefore likely to enjoy screening effects due to differences in elevation. This shows facades W and Y at the same elevation.

6.6. This view is directly opposite the planned location for the new plant and comprises a staircase block at the end, Loc J, albeit in context this is not regarded as particularly noise sensitive. At roof level of the school there appear small windows serving a room of an unknown use, Loc K and then at lower storey heights going west are school rooms, of Noise Sensitive Receptor NSR1. The lower floors benefit from some screening. The windows of other facades Y are more distant, albeit at the same elevation. Façade X is at a lower elevation and screened from view.

6.7. At roof level of the school there are velux windows to classroom below, and a roof passive air vent in the apex of the roof. Adjacent to the velux windows and upto the perimeter of the school is a roof terrace, not visible. Façade Z is screened from view.



6.8. A residential block with balconies on façade V is hidden from direct lines of sight from the proposed location of the new plant, although this shows a view taken at the corner of the existing plant room enclosure that will provide screening.

6.9. The noise calculation for NSR1 is shown in Annex C. This shows that the nearest façade opposite leads to a rating level of LAeq,15min of 43.5dB, which compares with a background level LAF90,15min of 48 dB, with a difference between the two of 4.5 dB. Since a difference of 10 dB is desirable, implies the need to upgrade the visual screen for an acoustic rated Louvre screen. To overcome any uncertainties in the limited nature of the background noise measurements and any uncertainty from the noise data for source, it is recommended the acoustic rated Louvre screen be deployed around the perimeter of the equipment to a height of 2m, and its distance from the units comply with manufacturers minimum distance. The screen can surround the equipment meeting the existing plant room enclosure with suitable doors for maintenance access.

6.10. Industrial Acoustics, iac-acoustics.com provide a Slimshield™ louvre screen, with suitable performance from the SL 150 version, although the SL 300 version is said to provide a smaller pressure drop and therefore will help to ensure adequate ventilation, whilst also provide acoustic screening.

7. CONCLUSIONS

7.1. The site relevant background noise level has been established as a reference against which the rating level of noise from the new plant can be compared.

7.2. The noise assessment indicates some mitigation is necessary, which can easily be accomplished by changing the planned visual screen for an acoustic rated screen to a height of 2m as a perimeter to the equipment. An example of a suitable acoustic screen is given.

7.3. The louder units should be deployed on the ends and the quieter units in between, using the original orientation planned.

8. ANNEX A – Basic Guide on Acoustic Terminology

8.1. The decibel dB is derived as a logarithmic ratio of sound pressures.

8.2. Measurement of sound levels involves a kind of averaging process in which the fluctuating pressure signal is squared, averaged and the square root obtained. This is known as rms averaging and takes place over a defined time interval. There are two standard averaging times, 1 second, known as 'S' response and 0.125 seconds known as 'F' response, with the latter mainly referred to in this report, as it better reflects the response of the human ear.

8.3. The A weighting in Sound Pressure Level dB(A) makes the noise meter approximately match the human auditory response that varies according to the magnitude change of sound pressure and its differential sensitivity to different frequencies. dB(L) signifies linear or unweighted.

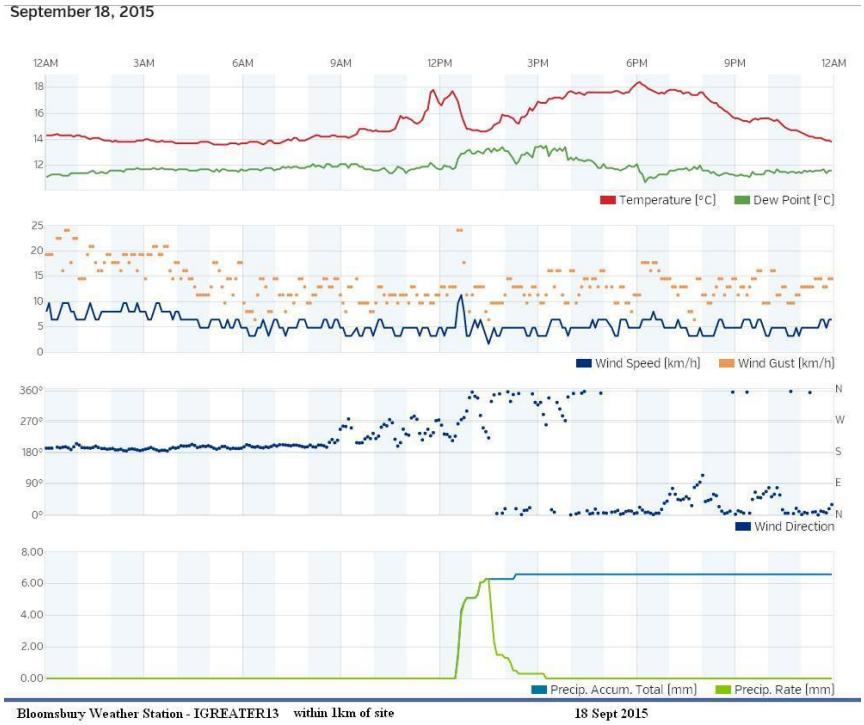
8.4. As the level of sound often fluctuates up and down, L_{eq} is a notional steady level, which over a given period of time delivers the same sound energy as the actual time varying sound over the same period. Fluctuating levels can thus by this metric be described in terms of an equivalent level. $L_{Aeq,T}$ shows the A weighted version, and the Time Period over which the equivalent level is determined is stated as T, in this survey T=5minute sequential samples.

8.5. $L_{A90,T}$ is the A weighted noise level exceeded for 90% of the specified measurement period (T). It can be taken to indicate the background noise level.

8.6. L_{AFMax} is the maximum value that the A-weighted sound pressure level reached during a measurement period using a Fast time constant.

8.7. A doubling in the amount of energy in sound (e.g. putting two identical sound sources close together) causes an increase of 3 decibels, which is noticeable but certainly not a doubling in the perceived loudness. As a guide it takes a 10 dB(A) increase for a doubling of perceived loudness or a 10 dB(A) decrease for a perceived halving of loudness.

9. ANNEX B Weather Archive, from a weather station within 1km of the site.



10. ANNEX C - Noise Assessment Calculation

source unit 1 - RZQSG100L8V1	57	dB A , heating mode		
source unit 2 - RXS50L	48			
source unit 3 - RXS35L3	49			
source unit 4 - RZQSG100L8V1	57			
combined, ignores unit spatial distribution	60.5	worst case		
directivity, reflection from plant room enclosure	3			
total source noise level	63.5			
Closest distance to NSR1 conservatively estimated from aerial map as 8m			High level narrow window at 13m	
distance decay, line source close in then spherical decay, loc J	15	dB	distance decay, line source close in then spherical decay, loc K	19
Screening, directly opposite façade	5	dB	Screening	0
specific noise level at NSR1	43.5	dB		
character penalty	0			
Rating Level LAeq,15min	43.5	dB	rating level and background level free-field	
Locations J and K achieve ‘similar’ rating level			add 3dB to each for absolute façade levels	
			background level LAF90, 15min	48
			target -10dB	38
difference between background level and rating level	-4.5			
desirable difference	- 10			

Mitigation - use acoustically rated Louvre Screen perimeter 2m tall , Slimshield SL 150, www.iac-acoustics.com. Note SL 300 offers smaller pressure drop.