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Environmental impact assessment.

Addendum 2

Address:

48 Red Lion St, Holborn, WC1R 4PF

Client:

Greenleaf restaurant

Greenleaf investor

10 May, 2012

Engineer: Simone Longo AMIOA

Addendum 2: *Summary.*

Preface:

This paper is written to complement the existing acoustic report for the proposed plant at the first floor flat roof at the rear of 48 Red Lion St. Holborn, WC1R for the Green Leaf restaurant.
Object of this paper is to provide details of a suitable noise mitigation measure and to demonstrate compliance with noise regulations.

Since changes have been made to the initially proposed plant and equipment installed as part of the kitchen canopy air extraction system which now emits more noise, the relative noise emission levels predictions of the earlier report needs to be updated, a new mitigation measure will be proposed to mitigate the noise at the site in respect to several noise sensitive locations which will be described in details.

This paper will refer back to the original report dated 22 July 2011 for what concerns the environmental noise assessment, environmental noise level readings, instrumentation and assessment location, but will consider these within the context of a new installation, and new resulting noise emission levels from the plant.

A new mitigation measure will be devised and described, and compliance with noise regulation will be demonstrated in respect to the nearest noise sensitive locations.

1.0 Description of the equipment and relative noise emission.

1.1 According to the Independent survey report by Douglas Price a new kitchen canopy air extractor system have been specified and details forwarded to me for the purpose of assessing the noise levels.

1.2 Operating hours and location of the plant remain unchanged and are specified in the previously submitted report.

1.3 Kitchen extractor unit.

1.3.1 The new system specification.

Maker and model N.	Noise emission level published by the manufacture.
Flaktwoods: 50JM DX 511466 (axial fan)	56 dBA @ 3m
Flaktwoods: Fan 50JM + 50JM In line attenuator.	Fan + silencer 46 dBA @ 3m

1.3.2 Fan noise data as presented by the manufacture.

JM Aerofoil

Product Code	Speed rev/min	Motor	Product Number	220-240V/50Hz/1ф					Speed Controller		*Sound Level dBA	
				Pitch Angle (°)	Motor Rating (kW)	Full Load Current (at 230V) (A)	Starting Current (at 230V) (A)	Wiring Diagram Ref	Electronic	Transformer	Fan	Fan & Silencer
50JM/20/4/6/...	1420	CT5	DX511466	32	0.52	3.9	7.8	CD1705	ME1.6	MT1.5	56	46

1.3.3 As suggested by the manufacture technical support team an additional 3dBA correction should be added to the total noise output of the fan stated above as safe margin for account for increases in air pressure, this will be taken into account in the predictive noise calculations.

1.4 Heat exchanger (compressor) units.

1.4.1 The two heat exchanger units (compressor) already considered in the previous report manufactured by Sanyo will be installed at the rooftop.

1.4.2 Details remain unchanged

1.4.3 Relative noise emission level as declared by the manufacture is given below in tabular form.

Sanyo Unit model N.	Manufacture declared SPL assumed @ 1m hemispherical (worst case considered)
SPW-C366VH	52 dBA
SPW-C256VH	56 dBA

2.0 Background environmental noise.

2.1 The lowest LA90,15min. within the period of interest.

2.1.1 Please refer to the previously submitted report for the survey data details.

Measured within the period if interest 08.00 to 23.00
43.4 dB LA,90,15min

3.0 Description of the noise sensitive receptors locations at the site.

3.1 It must be said that, at the site first floor flat roof-top at the rear of 48 Red Lion St. it is quite a busy and complex environment in terms of locations affected by the plant noise emission.

3.2 There are three sensitive locations that will be described individually.

3.3 The first noise sensitive location is a property at the same level (first floor flat roof) of the proposed plant, below is a picture showing the current installation and the noise sensitive location marked “A”.

3.4 This specific location is approximately 1 m distant from the edge of the proposed enclosure (1080 mm) from the draft drawings.

3.5 Fig location "A"

3.6 The second noise sensitive window is located at one floor above at the distance of approximately 4.5 m from the proposed flue outlet, this will conventionally named noise sensitive location in "B"

3.7 Location "B" is displayed below in a draft of the proposed installation submitted by seed design.

3.8 This noise sensitive window faces directly the proposed installation, but is at one floor above the plant level.

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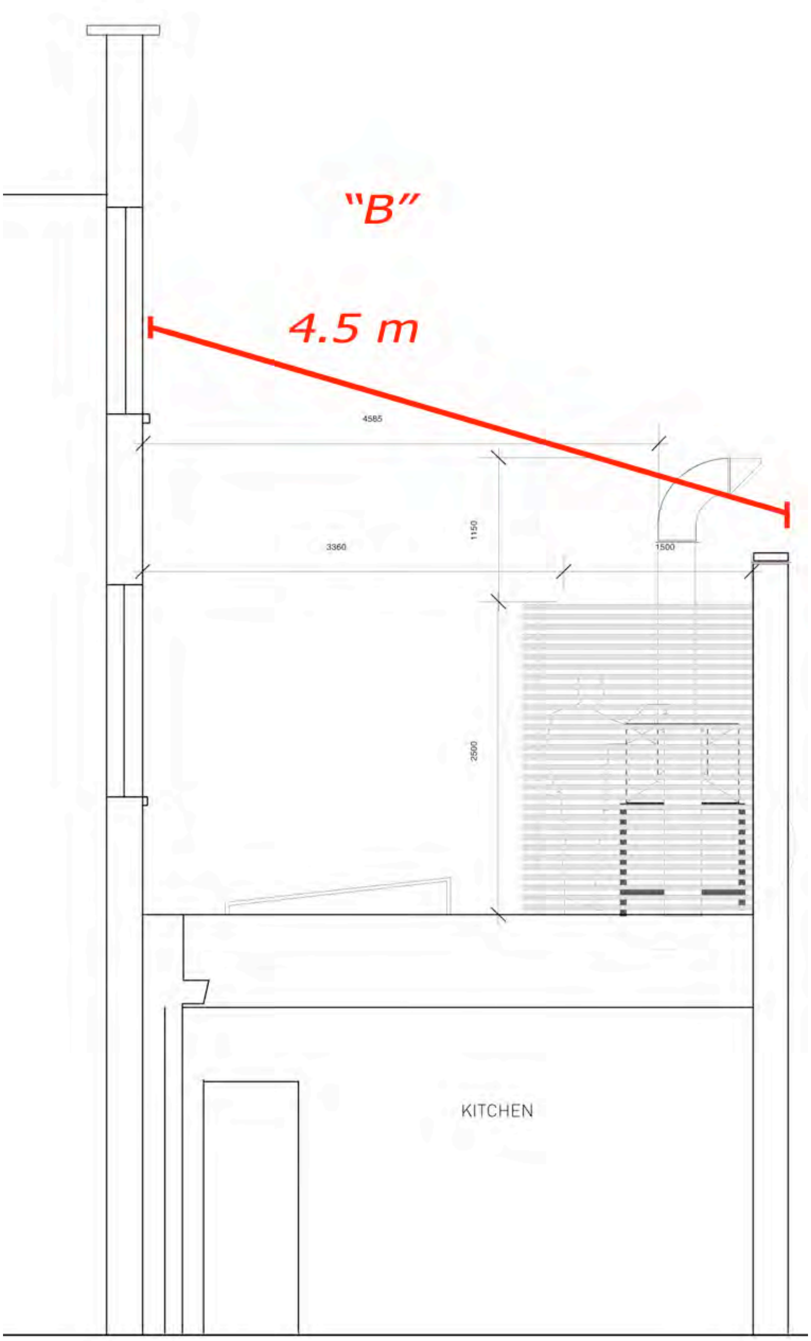
3.9 Fig showing noise sensitive location "B"



3.10 A further noise location conventionally named as "C" is situated at the rear of the building, in this case the window does not faces the installation, instead it is located at one floor below facing the opposite direction.

3.11 The distance estimated from the plant and the centre noise sensitive window in "C" is approximately 4 m however in this case additional noise screening caused by the wall and window position in respect to the plant must be taken into account for the predictive noise calculation.

3.12 Fig for receptor location "C"

3.13 The third sensitive location named "C" seems to be a PVC/glass window and door next to each other on a small balcony, seen from the picture 3.13 the door is hidden by a wall.

4.0 The proposed noise mitigation measure.

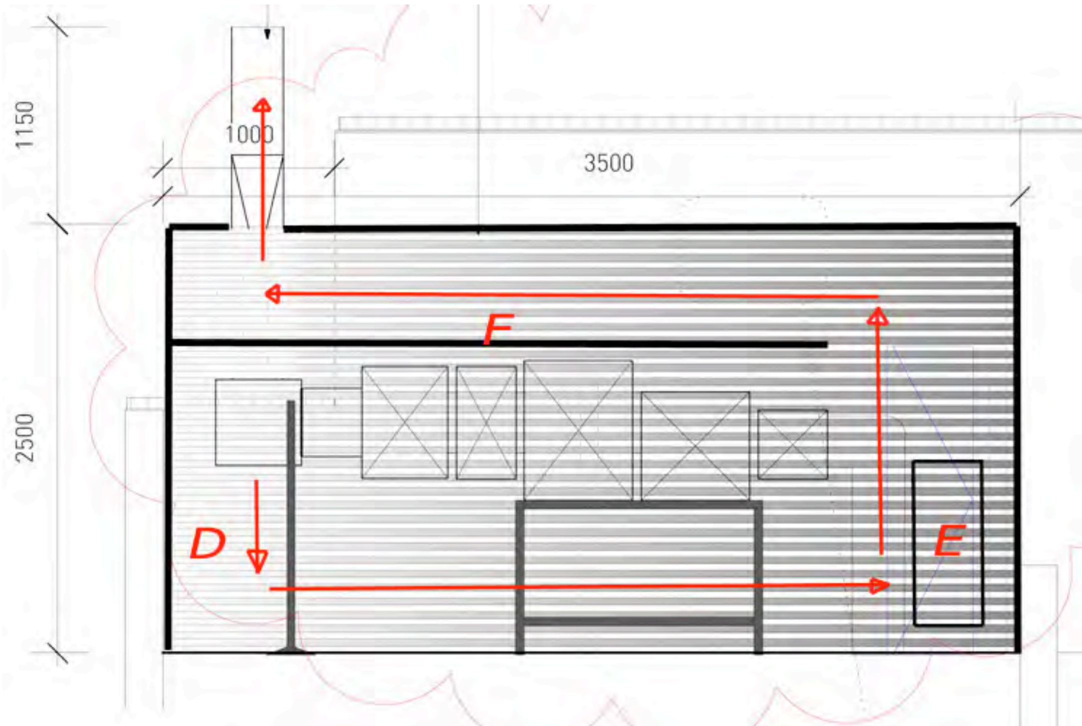
4.1 For the mitigation I propose an acoustic enclosure, similar of what was already proposed in the earlier report, but this time taking in account the new noise requirements.

4.2 Draft design have already been submitted by Seed Design concerning the external aspect dimension and bend duct discharger according with the independent survey report by Douglas Price.

4.3 Working on the basis of Seed Design draft my study will concern only the noise reduction, I propose the following solution:

4.3.1 Internal design of the proposed enclosure and air-flow pathway diagram.

4.3.1.1 Fig showing internal section of the enclosure.



N.B.
At point "D" the kitchen air outlet should discharge inside the enclosure pointing downward.
At point "E" the Sanyo heat exchanger
At point "F" an additional separating barrier will direct internally the air-flow as indicated by the red harrow towards the bend duct outlet passing by point "E".

5.0 Design challenge.

5.1 The mitigation of the noises from the plant involves enclosing all the equipment together in the same enclosure as shown at point 4.3.1.1

5.2 The initial concern is whether the air temperature coming from the kitchen extractor will be adequate to cool down the heat exchanger units.

5.2.1 For this I went on site to survey the temperature of the air from the current system operating at busy time.

5.2.1.1 With an infrared temperature sensor I verified the temperature of the air inside the air duct to be 17.5 C and I deemed this more than adequate to cool down the Sanyo units, since such units should be designed to operate in hot summer weather exceeding 45C I see no problem in cooling the units using the air flow from the kitchen extract.

5.2.1.2 The carbon and odour filter proposed for the new installation will also provide clean air for the Sanyo units to operate inside the enclosure.

5.2.2 Next challenge was to design an oversized air path inside the enclosure to prevent a built up in air pressure and evaluate whether the oversize air pathway would also let excessive noise escape into the environment.

5.2.3 It is possible to estimate the transmission loss caused by a partition or enclosure, using simplified acoustic calculations at a reasonable degree of accuracy if the envelope material of the enclosure envelope is of known acoustic characteristics.

5.2.4 The same cannot be said if the enclosure presents an opening and an internal baffle design such in the case of the current proposal.

5.2.5 Further complication is caused in this case by the presence of several receptors at different positions and distances but in near proximity from the proposed air outlet, the dynamic of the system present many unknown variables therefore a way of testing the idea holistically is preferred over distinct calculations based on established assumption.

5.2.6 To overcome the problem, a scale model of the proposed enclosure is built and tested in order to assess its noise reduction performance at the various receptor locations.

5.2.7 The scale model is built so to integrate receptor "A", "B" and "C" at their relative distance and position scaled by the scale factor so that, the noise level reduction could be directly measured in the simulated environment.

5.3 The principle in scale modelling is that all physical dimensions including the wavelengths are reduced by the scale factor.

5.3.1 "Noise level measured in the model do not represents the actual noise level experienced by the community since it is not practical to model the range of different noise sources present in real life. The difference in noise level measured before and after the barrier is erected, however, can be determined with the model simulation". (Quoted from: *"Acoustic scale modelling: A planning and design technique for meeting environmental noise standard" by Dean Robert Jonson A.B. Harward University 1967*)

5.3.1.1 Additionally the use of scale modelling allowed me to adjust and re-test the design configuration of the proposed enclosure to find an optimal solution, (barrier vs absorbtion), only the final outcome of the study will be presented here for simplicity.

5.3.1.2 The chosen scale factor for this project is 1 to 1/3 meaning that every dimension and the acoustic wavelength will be calculated at 1/3 its original dimension.

5.3.1.3 A scale factor of 1/3 has also the advantage that measurement can be taken with conventional class I instrumentation with a bandwidth up to 20Khz.

5.3.1.4 The A weighted sound pressure level difference before and after the enclosure is built will be estimated by taking a 1/3 Oct band flat frequency reading within the model, then shifting the 1/3 octave frequency by the scale factor before applying the A weighted sensitivity curve to the re-positioned 1/3 octave frequency band giving the real size expected acoustic performance.

5.3.1.5 Further adjustment of the reading to account for air absorption seems beyond the scope at this scale ratio and distance involved.

5.3.1.6 Furthermore, the scale model will be used essentially to estimate the amount of loss of insulation caused by the air outlet of the enclosure and the effect of noise absorption caused by the internal lining of acoustic absorber rather than the enclosure walls noise impedance.

5.3.1.7 This simplifies the construction of the model substantially as it avoids the needs to carefully model the construction material proposed for the outer layer, which can better estimated in another way.

6.0 Model testing procedure.

6.1 To simulate the noise source emission at its hemispherical radiation a miniature unidirectional loudspeaker is placed on a flat reflective surface.

6.1.1 The loudspeaker is placed approximately the position of the real noise source within the modelled plant.

6.1.2 Broadband noise is used and frequency spectrum adjusted to obtain a flat reading from 250Hz to 20Khz which are the useful frequencies for this test, in a 1/3 scale ratio these corresponds to 6.6Khz down to 83Hz.

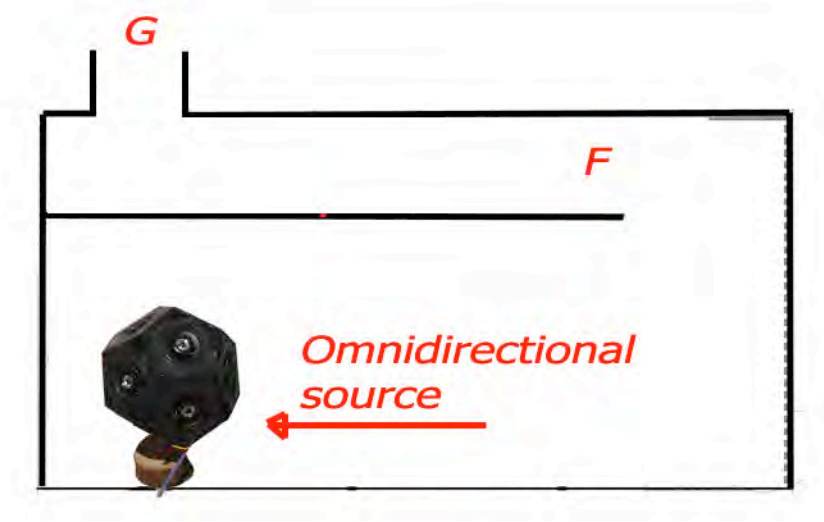
6.1.2.1 Noise level is measured at receptor position “A”, “B” and “C” within the model, first without the enclosure, then the enclosure is built around the loudspeaker.

6.1.2.2 Subsequently acoustic absorber is added inside the enclosure in various patterns.

6.1.2.3 Finally a hole is cut open on top of the enclosure and a bend duct is inserted.

6.1.2.4 Noise level measurements are repeated at each model alteration at the equivalent receptor position “A”, “B” and “C” within the model to evaluate the effect in the noise emission.

6.1.3 Fig showing a sectional layout of the testing arrangement.



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6.1.4 Fig showing enclosure construction and testing phases.

6.1.5 The enclosure dimensions have been built in a 1 to 1/3 ratio, the additional internal partition "F" was kept at approximately 1.25 times the open surface area of the proposed kitchen air-duct outlet (500mm = 1963 Square cm) the open air passage in scale ration equal to 2496 square cm, and the PVC bend duct used in the model is a 200 mm diameter which would represent in scale ratio a duct of 600mm diameter, therefore the air passage in the model is oversized to warrantee unobstructed air flow.

6.1.6 Measurement where carried out at distance equivalent to the scale ratio of receptor "A" "B" and "C" over the relative reflecting surfaces, the enclosure was tested with and without the air-duct opening (with the enclosure completely sealed) in order to evaluate how the noise emission was affected by each changes.

6.1.7 Rockwool used for the internal leaning is 20mm thick at 100Kg/cubic m.

7.0 Outcome of the tests and its relation with the real size problem.

7.1 Since the manufacture of equipment used in this project (is assumed to) giving noise level emissions as SPL at 1 m and 3 m hemispherical radiation, I will first use the model to find out what happen when a hemispherical source of noise is placed in the proposed enclosure.

7.2 The difference in level of the Omni directional loudspeaker measured on a reflecting plane (hemispherical) will be subtracted to the level of the same Omni directional loudspeaker measured inside the enclosure, all six internal sides lined with 20mm rock wool.

7.2.1 Tab. Estimating source noise difference

Measured on a hemispherical radiation over reflecting surface	100.55dBA LAeq30sec.
Measured inside the enclosure all sides lined with rock wool 20 mm.	95.92dBA LAeq30sec
Difference due to absorption. (Will be subtracted from the source noise of the plant)	4.6dBA

7.3 Further this result the internal noise emission in the proposed real size enclosure can be estimated as follow

7.3.1 Tab. Estimating source noise in the real life enclosure.

Model	@ 1 m	@ 3 m
Sanyo SPW-C366VH	52dBA	42.4dBA
Sanyo SPW-C256VH	56dBA	46.4dBA
Flaktwoods: 50JM DX 511466 (axial fan)+ 50JM silencer. + 3 dBA Correction for increase in air pressure.	58.4dBA	(46+3)=49dBA
Cumulative noise level of all equipment operating simultaneously in close proximity (@ less than 1 m distance)	60.9dBA	51.4dBA
Minus a correction for the internal leaning absorption (-4.6 dBA)	56.3 dBA	

7.4 Once the internal noise level is known then next step is to estimate the required noise reduction of the enclosure envelope, since the nearest noise receptor is “A” at 1 m distance from the enclosure surface, the internal noise level should be reduced at -10 dBA below background noise by the enclosure envelope alone, the air outlet will be considered in its own merit at later stage.

7.4.1 Tab. To estimate the enclosure envelope required noise reduction.

Background noise LA90,*T* -10 dBA	(43.4 -10)= 33.4dBA
Minus internal noise	56.3dBA
Required Apparent noise reduction *R*,	22.9dBA

7.4.2 The estimated noise reduction required for the enclosure enveloped can be achieved by acoustiblok 3 mm membrane having STC of 26, however to maintain coherence with the model used for testing, the internal sides of the enclosure should be lined with at least 50 mm rockwool having density of 100Kg/cubic m.

7.5 I will proceed with estimating the noise emission contribution of the enclosure air outlet as it arrives at the receptors.

7.5.1 For the estimation of noise, the noise emission from the air outlet arriving at the receptors will be considered as a “specific noise’ emission separated by the noise emission from the enclosure itself, for this purpose noise arriving at the receptor was first measured with the enclosure sealed and then with the air outlet cut open and bend duct inserted.

7.5.2 This estimate calculation will be based on the BS 4142 method using the noise measured with the sealed enclosure as the background noise to obtain the specific noise level radiated from the bend duct outlet.

7.5.3 For this reason, rather than attempt to model the enclosure envelope in a scaled ratio to simulate its noise impedance, I found more useful to build an excess of noise attenuation in the enclosure envelope in the hope of measuring a certain noise increase after the air outlet was opened and so be able to estimate its contribute, in practice for the experiment to succeed the enclosure envelope of the model needs to exceed the noise reduction necessary for the real size one.

7.5.3.1 Tab. To evaluate the specific noise emission from the air outlet.

Noise level	Pos. A dBA	Pos. B dBA	Pos. C dBA
Background noise with the source noise off.	52.1	52.1	52.1
With sealed enclosure	60.4	59.5	50.0
With 600mm air outlet / bent discharger inserted.	60.5	58.6	51.7
Diff	0.1	-0.9	1.7
Corr	N/A	N/A	N/A
Specific Noise	undetectable	undetectable	undetectable
- internal noise in the test model.	95.92 dBA	95.92 dBA	95.92 dBA
Transmission loss.	35.4	37.3	44.4

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8.0 Conclusion.

8.1 The experiment demonstrates that, in the current configuration the specific noise level emission from the air outlet is undetectable and the overall attenuation will be determined solely by the enclosure envelope.

8.2 The specified enclosure will decrease the nose from the plant to -10 dBA below the background noise therefore the plant complies with noise regulation.

Approved for Issue on behalf of
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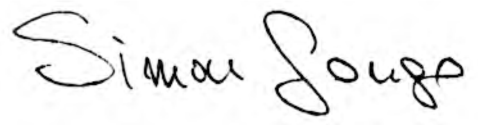
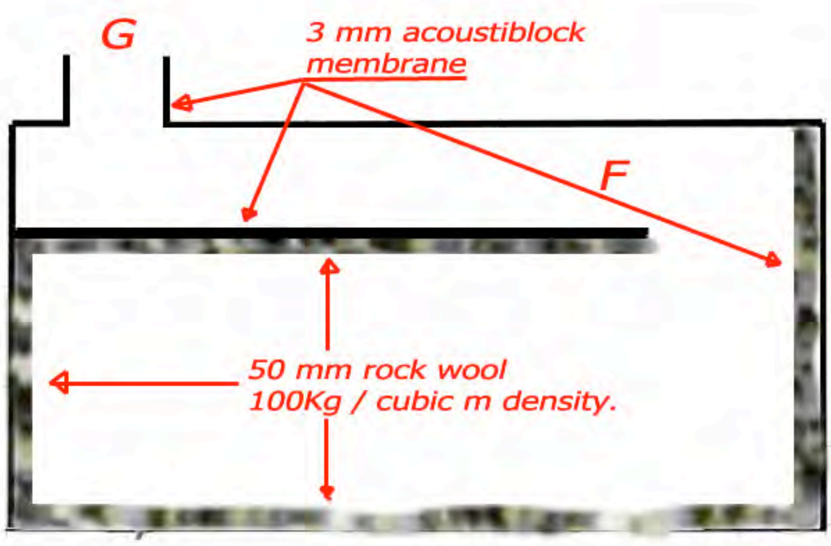


Simone Longo
Acoustic Engineer

AMIOA – AIA

Appendix D

Enclosure section details:



Description:

Enclosure envelope and internal buffer (F) made of 3mm acoustiblok membrane.
Rockwool mineral absorber lined on all 6 internal sides except the internal baffle (F)
All air gap carefully sealed.
An opening access for maintenance should be built using a standard PVC window frame with preferably 4mm glass or 2 mm metal sheet, both internally lined with rock wool.

Appendix E

Instrumentation.

Instrument type:	Norsonic Sound Analyser Nor-140		Serial no: 1403371
Preamflifier type:	Norsonic Type Nor-1209		Serial no: 12247
Microphone type:	Norsonic Type Nor-1225		Serial no: 24301
Traceable periodic laboratory verification by:	Gracey & Associate		
Date of last verification:	07.07.2010		
Microphone position:	At the scale ratio of 1 m from the building façade.		Operator: Simone Longo
Measurement title:	1/3 scale ratio		Date: 5-7/05/2012
Measurement duration: 30sec		Period length: 30sec.	Filter bandwidth: (A) and 1/3 Oct
Initial calibration level: 114.0 dB		Sampling frequency: 50ms	End calibration level: 114 dB
Calibrator type:	Norsonic Type 1251		Serial no: 31943
Traceable periodic laboratory verification by:	Gracey & Associates		
Date of last verification:	10/04/2012		