Proposed plant equipment - acoustics study

YA114.P1

Z Hotel Wild Court

4 Wild Court

London

WC2B 4AU

Manchester, UK

Version 2.0

April 8, 2019

Identification

Title: Proposed plant equipment - acoustics study: Z Hotel Wild Court
YA114.P1
Client: Kane Group Building Services (KGBS)
Date: April 8, 2019
Local: Manchester, UK
Version: 2.0
Prepared by: Luis Pereira
Prepared for: KGBS

Revisions

Date	Changes / Comments	Reviser
22/02/2019	Report updated as per Aaron McGeown's email received on the 22/12/2019, regarding change of 5^{th} Floor AHU model.	LP

Contents

Acronyms & abbreviations

KGBS Kane Group Building Services. 2, 8, 9, 18

LBC London Borough of Camden. 8, 9, 10, 11, 18

NSR noise sensitive receiver. 9, 10, 15

SPL sound pressure level. 11

SWL sound power level. 11

Glossary

L_{A90} Background sound level - A-weighted sound pressure level obtained using time-weighting "F", that is exceeded for 90% of the time interval considered. 10

$L_{Ar,Tr}$ Rating level - specific sound level plus any adjustment for the characteristic features of the sound, for a specified interval over which the specific sound level is determined. 10, 13, 14, 16

Summary

This report has been prepared in support of a planning application for the conversion of an existing building into a hotel complex at 4 Wild Court, London WC2B 4AU.

Criteria previously set by the Local Authority requires that noise emissions related to plant and equipment for the development is below set limits.

Predictions of noise emitted by plant units have been carried out to identify if current proposals are compatible with such limits.

Mitigation solutions have been determined to be required and its details are presented as Section 6.

1 Introduction

A conversion of an existing building into a hotel complex is proposed at 4 Wild Court, London WC2B 4AU.

Yacoustics has been commissioned to undertake an assessment of the plant units being proposed by KGBS and provide advice on mitigation measures that may be required to achieve the environmental noise limits set by the London Borough of Camden (LBC).

Calculations of noise propagation have been carried out in line with ISO 9613-2 [1], based on each plant item noise emission characteristics, the architects plans for the development and the site characteristics.

2 Proposed development

The proposed development consists of the following:

"Change of use from private College (Class D1 Use) to Hotel (Class C1 Use), new 7th and 8th floor roof extensions, and reinstatement of commercial entrance and ancillary café onto Kingsway, with new plant and other incidental works".

2.1 Proposed mechanical units

A brief description of each mechanical unit, being proposed by KGBS and its location is as follows:

1. 5^{th} floor plant area
    a) AHU - BPS Horizontal Plate Fan;
    b) VRF Twin Condenser - Mitsubishi PURY-P350YNW-A; and
    c) VRF Single Condenser - Mitsubishi PURY-P200YNW-A.
2. 7^{th} floor plant area
    a) 2xAHU - SQFT Squif In-line Twinfans;
    b) 3xVRF Twin Condenser - Mitsubishi PURY-P500YNW-A; and
    c) 2xVRF Single Condenser - Mitsubishi PURY-P350YNW-A.

A layout of each plant area is presented as Annex A.

The noise emission characteristics for each of the above mentioned units, as provided by the manufacturers, are presented as Annex B.

2.2 Noise sensitive receivers

The LBC considers that a noise sensitive receiver (NSR) can be: residential units, educational establishments, hospitals, hostels, concert halls, theatres, law courts and broadcasting/recording studios.

A reference to the closest noise sensitive properties is included as Annex C.

3 Relevant criteria

The criteria which is relevant for this assessment has been taken from the acoustics report previously issue by Hoare Lea to the LBC[1] for planning approval purposes, and is presented as Table 1 together with the results of the survey carried out.

The stated criteria was derived from a long term site survey, which was carried out in line with BS 7445-2:1991 as required by the Council, and is applicable to all mechanical units.

Table 1 – Relevant criteria

Period	Min. L_{A90}dB	Max. plant $L_{Ar,Tr}$dB
at relevant NSR (see Section 2.2)		
Day (07:00 - 23:00)	51	46
Night (23:00 - 07:00)	50	45

[1] As per LBC requirement, if the plant noise is expected to be tonal or create a perceptible hum hiss or whine, the above noise limits will be reduced further by 5 dB(A).

[1] REP-1006613-05-20170314-AcousticandVibrationSurvey-Rev00

4 Methodology

To assess the requirements set out by the LBC, predictions of the noise emitted by the proposed mechanical units have been carried out by means of a digital geometric acoustics software, in line with the methodology laid out in ISO 9613-2:1996 [1].

Furthermore, since the data provided for the Mitsubishi units is set in terms of measured sound pressure level (SPL), a conversion to sound power level (SWL) has been carried out in accordance to the principles of BS EN ISO 3744 [2].

The methodology employed can be briefly described as follows:

1. Production of a digital geometric acoustics model, representative of the proposed development and its surroundings:
   a) Site layout: Data of the site layout and model dimensions has been taken from the Architect drawings and from Google Earth;
   b) Surfaces absorption characteristics: All building surfaces absorption have been set as $\alpha = 0.1$ (0.5 dB reflection loss);
   c) Ground factor: Ground factor have been set as 0;
   d) Order of reflections: A reflection order of 3 has been used[2].
2. Calculation of each relevant unit SWL as follows:
   a) Calculation of the area S of the measurement surface in line with the following equation:

$$S = 4(ab + bc + ca) \tag{4.1}$$

   where:

$$\begin{aligned} a &= 0.5l_1 + d \\ b &= 0.5l_2 + d \\ c &= l_3 + d \end{aligned} \tag{4.2}$$

   where:

[1] ISO 9613-2:1996 Attenuation of sound during propagation outdoors - Part 2: General method of calculation.

[2] A suitable reflection order has been determined based on the site geometry and the source-receiver positions.

l_1 is the length of the reference box;

l_2 is the width of the reference box; and

l_3 is the height of the reference box.

b) Calculation of sound power levels using the following equation:

$$L_W = \overline{L_p} + 10lg\frac{S}{S_0}dB \tag{4.3}$$

where:

S is the area in square metres, of the measurement surface;

S_0 is the reference area = $1m^2$; and

$\overline{L_p}$ is the surface time-averaged sound pressure levels[3].

3. Positioning and configuration of each relevant source as a point source;

4. Configuration of a receivers grid (with a 5x5 meters resolution) as to determine which part of the closest sensitive properties are the most exposed to the emitted noise;

5. Configuration of the NSRs determined to be the most exposed; and

6. Calculation of noise emissions.

[3] Provided by the manufacturer in Annex B

5 Results & initial conclusions

The facade specific areas determined to be the most exposed, and the subsequent defined receivers (NSR A and B) are included as Annex D. Results of the predicted noise emissions are presented as Tables 2 and 3.

The predicted noise emissions exceed the limits stated within Section 3 and as such a mitigation strategy was devised and is presented in detail in Section 6.

Table 2 – Calculated noise emissions at NSR A

Source	Location	Octave band (Hz) $L_{Ar,Tr}$(dB)								Global
		63	125	250	500	1k	2k	4k	8k	dB(A)
BPS (Break-out)	5^{th} floor	32	15	18	0	-5	-20	-34	-46	11
BPS (Intake)		28	21	17	13	2	-5	-14	-22	14
BPS (Discharge)		38	19	35	24	18	14	5	-5	28
PURY-P200YNW-A		52	33	24	18	7	-2	-11	-21	27
PURY-P350YNW-A		41	36	27	25	13	4	-7	-20	26
PURY-P250YNW-A	7^{th} floor	65	49	48	42	32	30	27	22	45
PURY-P350YNW-A (1)		57	49	51	46	41	32	24	19	47
PURY-P350YNW-A (2)		55	51	50	49	39	34	26	19	48
PURY-P500YNW-A (1)		69	59	61	55	45	43	38	33	56
PURY-P500YNW-A (2)		75	63	62	55	45	43	39	33	58
PURY-P500YNW-A (3)		68	54	53	46	44	37	32	23	50
SQFT (Inlet)		77	76	63	52	47	46	44	41	62
SQFT (Break-out)		68	65	57	46	38	38	30	19	53
SQFT (Outlet)		68	70	51	44	40	40	37	33	55
SQFT (Break-out) (2)		52	62	41	32	27	25	17	3	46
All sources	-	80	78	68	60	53	50	47	43	65

Table 3 – Calculated noise emissions at NSR B

Source	Location	Octave band (Hz) $L_{Ar,Tr}$(dB)								Global
		63	125	250	500	1k	2k	4k	8k	dB(A)
BPS (Break-out)	5^{th} floor	42	28	38	27	22	11	1	-9	31
BPS (Intake)		46	42	54	50	50	44	38	34	54
BPS (Discharge)		52	44	58	51	49	41	37	32	54
PURY-P200YNW-A		66	49	44	44	36	32	31	29	46
PURY-P350YNW-A		58	50	51	47	42	37	32	27	48
PURY-P250YNW-A	7^{th} floor	38	28	26	19	10	3	-1	-11	21
PURY-P350YNW-A (1)		42	29	28	19	10	-1	-13	-24	23
PURY-P350YNW-A (2)		41	29	29	19	9	0	-11	-24	23
PURY-P500YNW-A (1)		50	36	30	20	10	4	-6	-19	27
PURY-P500YNW-A (2)		55	37	32	21	13	4	-6	-18	31
PURY-P500YNW-A (3)		53	39	29	19	12	4	-7	-20	29
SQFT (Inlet)		56	54	35	25	18	15	9	0	39
SQFT (Break-out)		50	52	35	23	20	16	8	-6	37
SQFT (Outlet)		63	65	44	38	40	39	37	32	51
SQFT (Break-out) (2)		56	57	34	26	19	14	4	-11	42
All sources	-	69	66	60	55	53	47	43	38	59

6 Method of compliance

The proposed mitigation strategy consists of installing a 2.3 meters opaque barrier at the perimeter of the 7^{th} floor plant area as indicated in Annex F. Such barrier is proposed to consist of the following construction:

Proposed opaque barrier: perforated metal sheet (as proposed by the architect) + 50 mm mineral wool + 18 mm plywood + 50 mm mineral wool + perforated sheet (inside).

For areas of the opaque barrier where louvres are required to allow for air flow, the system proposed to be used is the **Allaway Louvre Model AL3015**.

In addition, the mitigation solutions detailed in Table 4 are also proposed.

Technical documentation for each solution is presented as Annex F.

Tables 5 and 6 presents the predicted noise levels at each relevant NSR with the proposed mitigation strategy in place.

Table 4 – Proposed mitigation solutions

Source	Location	Indicative solutions
BPS (Intake) BPS (Discharge)	5^{th} floor	600 mm in-duct attenuator - CAICE
PURY-P200YNW-A PURY-P350YNW-A		Full enclosure - Allaway MODEL EP50/UF
SQFT (Inlet)	7^{th} floor	3000 mm attenuator - CAICE
SQFT (Break-out)		25 mm of mineral wool ($\rho \geq 60Kg/m^3$) + 15mm of plywood ($\rho \geq 650Kg/m^3$) + weather resistent layer
SQFT (Outlet)		3000 mm in-duct attenuator - CAICE
SQFT (Break-out) (2)		25 mm of mineral wool ($\rho \geq 60Kg/m^3$) + 15mm of plywood ($\rho \geq 650Kg/m^3$) + weather resistent layer

Table 5 – Calculated noise emissions at NSR A (with mitigation in place)

Source	Location	Octave band (Hz) $L_{Ar,Tr}$(dB)								Global
		63	125	250	500	1k	2k	4k	8k	dB(A)
BPS (Break-out)	5^{th} floor	32	15	18	0	-5	-20	-34	-46	11
BPS (Intake)		20	7	-4	-19	-39	-48	-57	-55	-4
BPS (Discharge)		30	5	14	-8	-23	-29	-38	-38	8
PURY-P200YNW-A		39	13	-5	-18	-31	-41	-50	-81	13
PURY-P350YNW-A		28	16	-3	-11	-24	-36	-46	-80	4
PURY-P250YNW-A	7^{th} floor	54	37	32	27	18	11	8	-2	31
PURY-P350YNW-A (1)		44	39	38	35	27	20	13	4	35
PURY-P350YNW-A (2)		41	41	35	33	26	20	12	2	34
PURY-P500YNW-A (1)		59	49	45	36	25	25	19	10	40
PURY-P500YNW-A (2)		55	44	44	33	28	23	21	11	38
PURY-P500YNW-A (3)		52	43	38	33	27	24	18	9	36
SQFT (Inlet)		48	35	6	-6	-12	-16	-16	-20	24
SQFT (Break-out)		49	46	21	4	-4	-13	-31	-61	31
SQFT (Outlet)		44	29	-8	-13	-13	-16	-20	-26	19
SQFT (Break-out) (2)		45	37	13	-2	-10	-18	-37	-65	23
All sources	-	62	53	49	41	34	30	25	15	45

Table 6 – Calculated noise emissions at NSR B (with mitigation in place)

Source	Location	Octave band (Hz) $L_{Ar,Tr}$(dB)								Global
		63	125	250	500	1k	2k	4k	8k	dB(A)
BPS (Break-out)	5^{th} floor	42	28	38	27	22	11	1	-9	31
BPS (Intake)		38	28	33	18	9	1	-5	1	25
BPS (Discharge)		44	30	37	19	8	-2	-6	-1	29
PURY-P200YNW-A		53	29	15	8	-1	-7	-8	-31	28
PURY-P350YNW-A		45	30	22	11	5	-2	-7	-34	21
PURY-P250YNW-A	7^{th} floor	41	23	17	6	-3	-14	-22	-42	17
PURY-P350YNW-A (1)		37	27	23	15	6	-5	-16	-28	19
PURY-P350YNW-A (2)		41	28	26	16	7	-2	-13	-26	21
PURY-P500YNW-A (1)		50	36	30	20	10	4	-6	-19	27
PURY-P500YNW-A (2)		48	33	26	16	7	-1	-10	-23	24
PURY-P500YNW-A (3)		47	33	24	12	4	-3	-13	-28	23
SQFT (Inlet)		34	16	-23	-31	-40	-43	-49	-59	8
SQFT (Break-out)		24	27	-1	-21	-29	-41	-63	-94	11
SQFT (Outlet)		10	5	-37	-46	-49	-57	-69	-75	-10
SQFT (Break-out) (2)		16	23	-11	-27	-42	-54	-82	-100	7
All sources	-	57	41	42	30	23	13	4	3	36

6.1 Limitations

The predictions and solutions presented in this section do consider that each element that forms part of the proposed mitigation measures has been built/installed appropriately, i.e. with no considerable gaps or flaws in workmanship.

It is recommended that a specialist team ensures that after execution on site, the minimum required ventilation rate for each unit is in line with the manufacturer requirements.

The final mitigation design shall not cause constraints to the units maintenance requirements or other necessary requirements not specifically mentioned in this report.

Final considerations

It has been determined that with the stated mitigation measures in place, the mechanical units proposed by KGBS do comply with the acoustics criteria set by the LBC, as stated within Section 3 of this report.

Other mitigation solutions may also be adequate and can be considered if required.

Manchester, UK, April 8, 2019.

Luis Pereira
Director for Yacoustics
MSc (Hons) / EAA / MIOA (Membership No. 50580)

Bibliography

[1] ISO 9613-2:1996 Attenuation of sound during propagation outdoors - Part 2: General method of calculation. Standard, ISO, 1996. Cited in page 8.

[2] BS EN ISO 3744:2010 Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane. Standard, BSI, 2010. Cited in page 11.

Annexes

ANNEX A – Proposed plant layouts

NOTES:

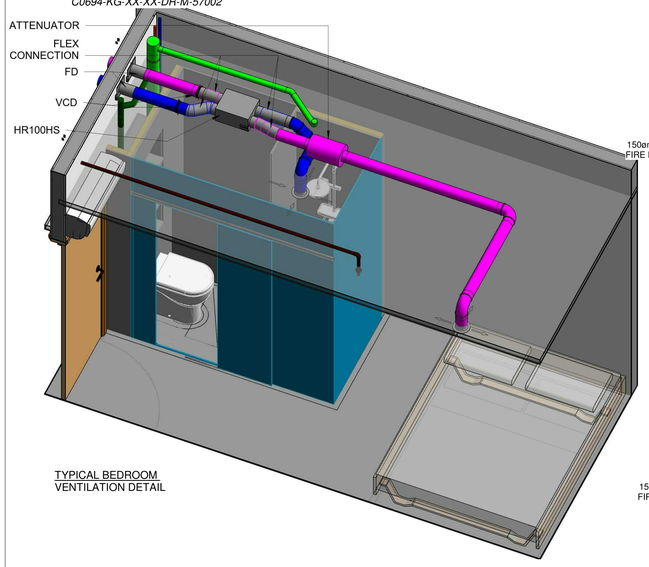
1. ALL DUCTWORK ENTERING ROOMS TO BE TYPICALLY 100mmØ DUCT (TYPICALLY 150mmØ SERVING FAMILY ROOMS)
2. ACCESS DOORS REQUIRED AT ALL FIRE DAMPER AND FIRE SMOKE DAMPER LOCATIONS FOR DUCT COMMISSIONING PURPOSES
3. WHERE SUPPLY AND EXTRCAT DUCTS GO TO ATMOSPHERE FIRE DAMPERS ARE REQUIRED
4. VCDS TO BE FITTED TO THE SUPPLY & EXTRACT DUCTWORK TO EACH HRU ON ATMOSPHERE SIDE SERVED FROM CENTRAL VENTILATION SYSTEM
5. THIS DRAWING TO BE READ IN CONJUNCTION WITH VENTIALTION SCHEMATICS:
   C0694-KG-XX-XX-DR-M-57001
   C0694-KG-XX-XX-DR-M-57002

DRAWING REFERENCE

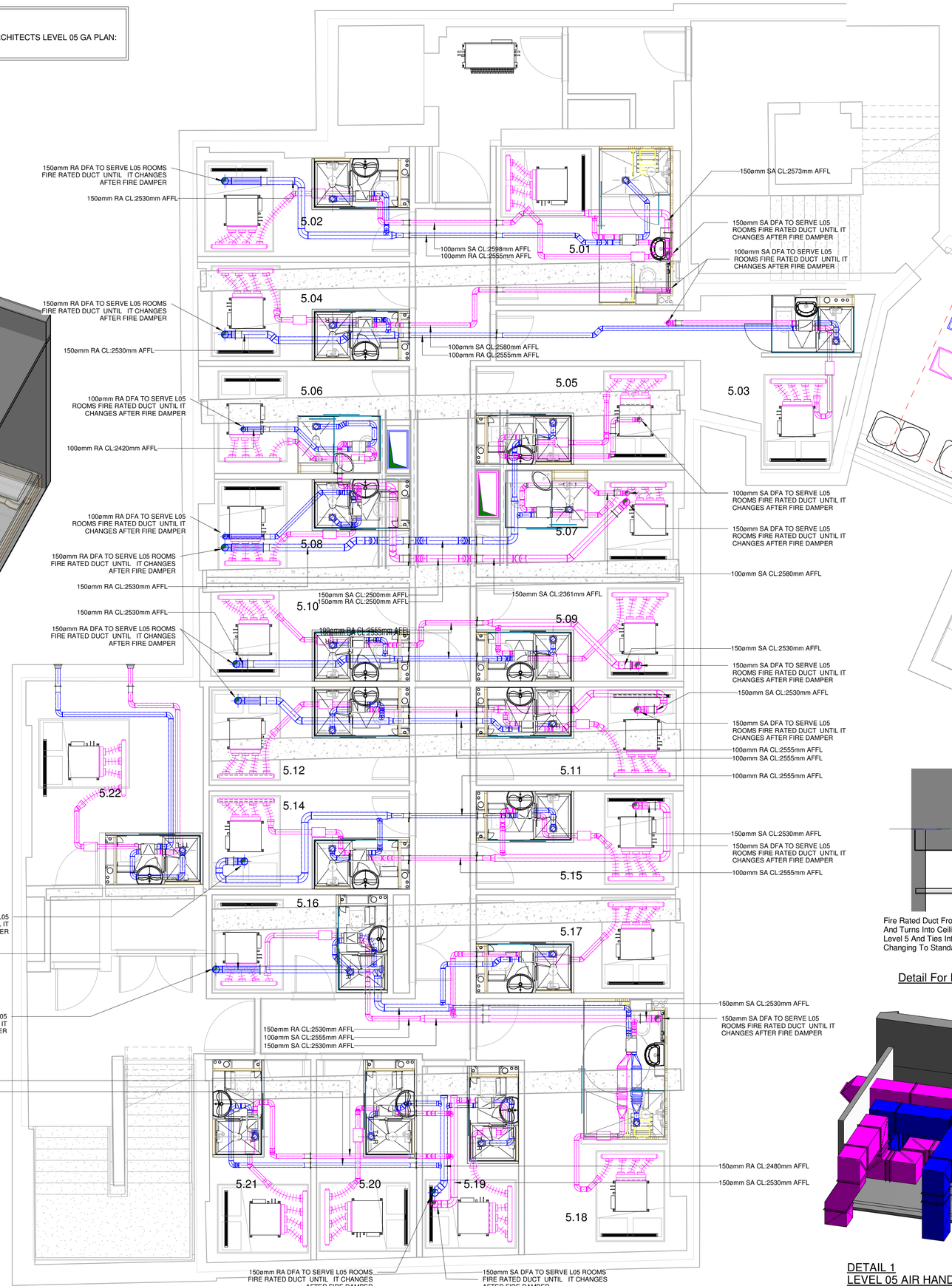
LAYOUT CURRENT WITH TT ARCHITECTS LEVEL 05 GA PLAN:
005-GA05-I6

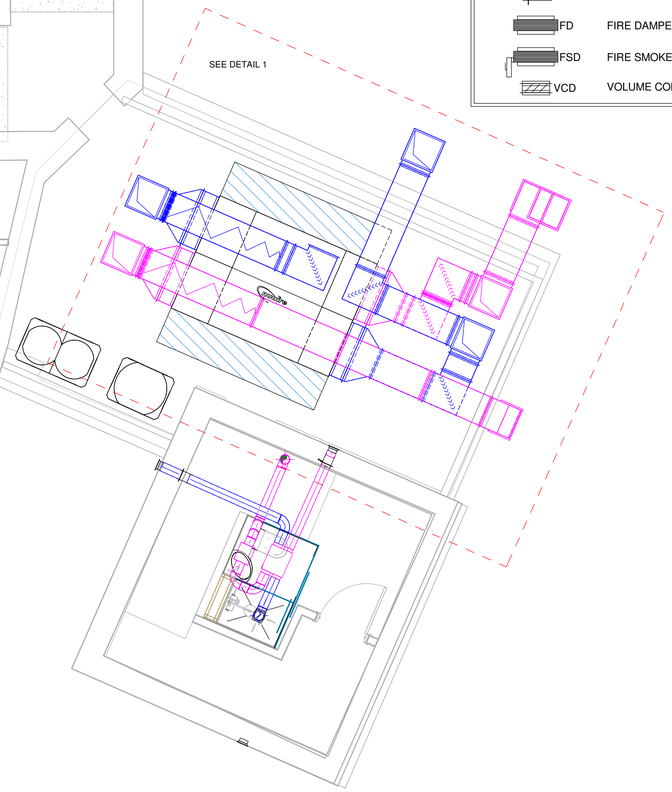
VENTILATION LEGEND

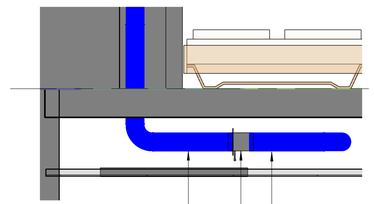
- SUPPLY AIR DUCTWORK
- RETURN AIR DUCTWORK
- FIRE RATED SUPPLY AIR DUCT
- FIRE RATED RETURN AIR DUCT
- FIRE RATED SMOKE VENT DUCT
- FIRE DAMPER
- FD FIRE DAMPER
- FSD FIRE SMOKE DAMPER
- VCD VOLUME CONTROL DAMPER



TYPICAL BEDROOM
VENTILATION DETAIL







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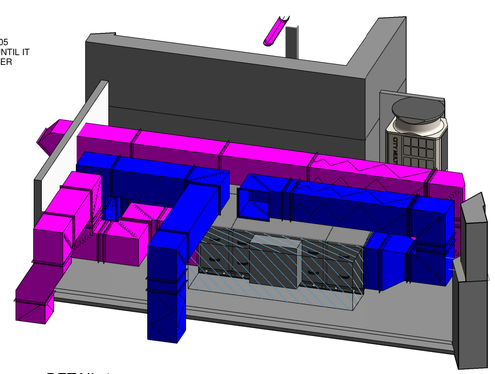
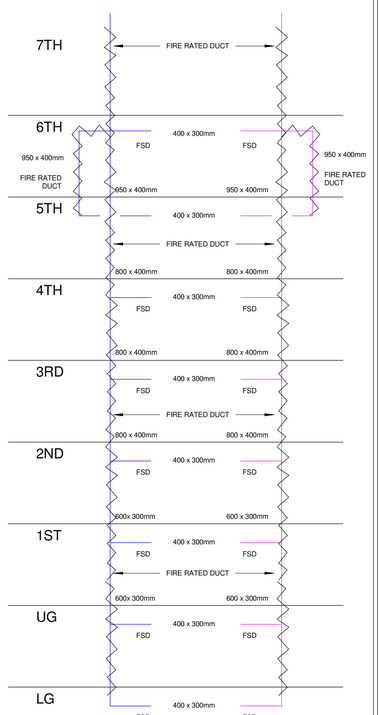
Detail For Duct Between Levels 5 & 6



DETAIL 1
LEVEL 05 AIR HANDLING UNIT SERVING BLOCK C

BUILDING A
VENTILATION RISERS



REV	DATE	BY	CHK	DESCRIPTION
C1	29/01/19	AF	MMcM	M&E SERVICES UPDATED TO 3D REVIT COORDINATED LAYOUT
P1	16/11/18	AMcG	MMcM	FIRST ISSUE

kanegroup Building Services

Job Title
Z HOTEL WILD COURT

Drawing Title
5TH FLOOR LEVEL VENTILATION LAYOUT SHEET 1 OF 1

Client
Z HOTEL

Architect
TT

Drawn	Checked	Approved	First Issue Date
AF	MMcM	MMcM	16/11/18

Scale @ A1	Drawing Status	PAS
1:50	CONSTRUCTION	A4

Project	Originator	Zone	Level	Type	Role	Number	Rev
C0694	KG	XX	05	DR	M	57_001	C1

BIM 360://C0694 - Z Hotel Wild Court/C0694-KG-XX-XX-CM-MEP-80001.rvt