aulos ACOUSTICS

Rooftop Extension 163 Iverson Road, London NW6 9RB

Acoustic Investigation Report

29 July 2021

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Acoustic Investigation Report

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Rooftop Extension 163 Iverson Road, London NW6 9RB

Acoustic Investigation Report

Summary

Aulos Acoustics has reviewed the potential environmental noise impact on future and existing residents due to the proposed rooftop extension of 163 Iverson Road. The context of the review has been existing 163 and 159-161 Iverson Road properties. Both have been extensively assessed over a long period to provide a quiet internal noise climate.

Providing comparable performance and control will protect amenity, maintain reasonable sound levels and provide a consistent environment with neighbouring flats.

The proposed extension has been modelled, based on current operational railway timetable - the recommended method of current, repeatable assessment methods. No change in sound level is expected between fourth and fifth floor. Current and future change in internal sound level is minimal and will make no perceptible difference to the internal noise climate. The sound levels will comply with current criteria of LB Camden.

The rooftop extension provides a building envelope and ventilation scheme of comparable sound insulation to existing 163 Iverson Road, as reviewed and approved under previous planning discharge as acceptable.

Daytime sound outside in amenity areas is expected to be equal to / below the normal limits in seated positions at all balconies and roof terraces and no greater than $L_{Aeq,16h}$ 60dB(A) while standing, which is less than for lower floors or areas directly exposed to road traffic noise.

Higher outside sound levels have been accepted in planning discharge for both existing buildings as suitable for an urban environment for elective use of balconies and roof terraces.

Protection of the existing residents from internal airborne and impact sound will be by maintaining the same 5dB sound insulation improvement between flats on current Building Regulations standards as approved for the existing building.

Profiled metal cladding has the potential to increase rain impact noise. Recommendations are made to control such noise to reasonable levels. It is acceptable for rain sound to be substantially greater than ambient sound under “heavy rain” conditions.

Residential amenity would be protected by providing:

- High sound insulation performance to the building envelope
- Moderate to high sound insulation for ventilation scheme
- High sound insulation performance between flats
- Control of noise in amenity areas
- Control of rainfall noise below new metal roofs or cladding

The proposed standard of acoustic treatment will require detailed development but is expected to provide a residential environment that is both reasonable and consistent with the existing building. The proposed acoustic treatment is based on the details approved under planning approvals for the existing building.

The proposed rooftop extension at 163 Iverson Road would be expected to provide reasonable and acceptable standards of residential amenity for future and existing residents. Amenity would be consistent with the existing building and with planning policy.

Rooftop Extension 163 Iverson Road, London NW6 9RB

Acoustic Investigation Report

Introduction

Aulos Acoustics has been appointed by Grosvenor Freeholds Ltd to investigate the future environmental noise impact on the proposed Rooftop Extension 163 Iverson Road, London NW6 9RB.

The project is the rooftop extension of an existing residential development comprising four fifth floor flats:

- 5-1 Two bedroom flat
- 5-2 One bedroom flat
- 5-3 One bedroom flat
- 5-4 Three bedroom flat

The application site is a potential noise-sensitive requiring an investigation of the effect of noise impact on amenity of residential property. The principal noise sources of concern are:

- Railway traffic
- Road traffic

The existing scheme incorporates a high standard of sound insulation. To maintain consistency with the current building it is proposed that the acoustic performance will replicate that of the building envelope and separating walls and floors.

The report investigates whether the use of the existing standard of acoustic performance will be adequate and reports the results and conclusions of the investigation.

Existing Scheme

The existing development of 163 Iverson Road was permitted under application reference 2012/0099/P dated 12/12/2012 and comprised "Erection of a part four and part five storey building plus lower ground floor comprising 33 residential flats (1 x one bed, 20 x two bed, 9 x three bed and 3 x studio flats) and 3 three-storey townhouses (Class C3), following the demolition of the existing garden centre buildings". Planning conditions were applied relating to noise and vibration as follows:

18 Before building works commence on the site, a scheme shall be submitted to and approved in writing by the Local Planning Authority providing for the insulation of the proposed dwelling unit(s) so that externally generated noise from railway and road traffic noise, do not cause internal noise levels to exceed an indoor ambient noise levels in unoccupied rooms of 30 dB(A) LA eq (1hour) and individual noise event shall not exceed 45 dB LAmax The development shall be carried out in such a manner to ensure that the above noise levels (from railway and road traffic) are to be retained for the next 15 years.

On completion, a test on each dwelling shall be carried out to verify compliance with this condition. A report shall be produced containing all raw data and showing how calculations have been made. A copy of such report shall be submitted to and approved in writing by the Local Planning Authority. The Noise report shall clearly contain standards used, measurements locations, raw tabulated and graphically represented data, time, date etc.

(For the residential accommodation the design and construction criteria for development of building shall have regard to the good criteria set out in BS8233:1999 Sound insulation and noise reduction for buildings - Code of Practice The scheme shall include full details on noise mitigation measures to be incorporated including window glazing and room ventilation

provisions Where ventilation is required it should be capable of achieving the same noise reduction as the closed glazing or building structure).

Reason: To safeguard the amenities of future occupants in accordance with the requirements of policies CS5 of the London Borough of Camden Local Development Framework Core Strategy and policy DP26 and DP28 of the London Borough of Camden Local Development Framework Development Policies.

19 Before building works commence on the site, a scheme shall be submitted to and approved in writing by the Local Planning Authority providing full details of the acoustic measures to be incorporated to ensure that the steady noise level does not exceed 50 LAeq,T dB in open spaces (including balconies) and open communal areas.

The development shall be carried out in such a manner to ensure that the above noise levels (from railway and road traffic) are to be retained (including maintenance) for the next 15 years.

On completion a test on each open communal including balconies shall be carried out to verify compliance with this condition. A report shall be produced containing all raw data and showing how calculations have been made. A copy of such report shall be submitted to and approved in writing by the Local Planning Authority. The Noise report shall clearly contain standards used, measurements locations, raw tabulated and graphically represented data, time, date etc.

Reason: To safeguard the amenities of future occupants in accordance with the requirements of policies CS5 of the London Borough of Camden Local Development Framework Core Strategy and policy DP26 and DP28 of the London Borough of Camden Local Development Framework Development Policies.

20 Before building works commence on the site, a scheme shall be submitted to and approved in writing by the Local Planning Authority providing for the insulation of the proposed dwelling unit(s) so that externally generated vibration from road and railway traffic do not cause any discomfort to its occupants as measured and interpreted by BS.6472:1992 "Evaluation of human exposure to vibration in buildings [1 Hz to 80 Hz]."

The scheme shall provide adequate insulation to prevent the transmission vibration from railway and road traffic to levels that are not perceived by the occupants as measured in BS.6472:1992 "Evaluation of human exposure to vibration in buildings [1 Hz to 80 Hz]."

Reason: To safeguard the amenities of future occupants in accordance with the requirements of policies CS5 of the London Borough of Camden Local Development Framework Core Strategy and policy DP26 and DP28 of the London Borough of Camden Local Development Framework Development Policies.

The environmental noise report submitted for the planning application was as follows:

- 1160 JT R556-52 dated 15/12/2011 Aulos Acoustics

Details in relation to these conditions were submitted and approved in application reference 2013/4129/P dated 11/02/2014.

The documents referenced in the discharge of planning condition are as follows:

- Environmental Intrusive Noise & Vibration Study dated 27/6/2013 by SOL Acoustics
- Internal Sound Insulation Review dated 24/6/2013 by Sol Acoustics
- Letter by SRL dated 3/12/2013 ref. C/30557/L02/JDH addressed to Tom Westwood

The building envelope sound insulation performance approved in the Sol Acoustics report was as follows:

Glazing Configuration	Minimum Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Allowing some exceedances of LAmax,FAST 45dB	23	27	30	39	43	43	50

Table 1 – Existing Window/Door Sound Insulation

Approximately R_w 42(Ctr-6) ±2dB

The approved performance for any acoustic ventilation system, including high performance acoustic vents with MEV or ducted vents with MVHR or centralised MEV are:

Trickle Vent Specification	Minimum Element-Normalised Level Difference - $D_{n,e}$ (dB) @ Octave Band Centre Frequency (Hz)						
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**
High specification trickle vent *2500mm² max. per habitable room (e.g. Greenwood Airvac MA3051)*	40	46	46	49	56	66	64

Table 2 – Existing High-Performance Ventilation

Approximately $D_{ne,w}$ 56 ±2dB

Note – the ventilation scheme only needs to attain such performances if directly exposed to the railway or roadside sound levels. Lower performance is acceptable without increasing internal ambient sound levels.

The range of window systems offered in the SRL letter above are:

- Idealcombi Futura+ [8.4mm laminated glass / 20mm cavity / 10mm glass]
- Idealcombi Futura+ [8.4 lam glass / 16mm cavity / 4mm glass + 10mm glass]
- Reynaers CS 68 ac_3813 Gasket [12.8 lam glass / 20mm cavity / 8.8mm lam glass]
- Olsen IV 92 ALU 2+1 SOiD [build-up unknown]
- Rationel Aldus [6mm glass / 18mm cavity / 8.4mm lam glass]

These are expected to comply with the ambient sound levels daytime and night-time and result in only a small number of exceedances above $L_{Amax,FAST}$ 45dB following detailed review in application reference 2013/4129/P for the Existing building.

SRL presented the range of exceedances based on Sol Acoustics survey data and their own analysis. There is no reason to consider the operation of the timetable or tracks has changed in the interim, so the predicted exceedances hold for noise events.

The above windows and acoustic performance would be expected to result in only 10-15 exceedances of $L_{Amax,FAST}$ 45dB per night due to road or rail traffic movements inside bedrooms at night.

The performance criteria are in line with the WHO Guidelines [WHO 1999] (1) and Noise Level Guidelines of ProPG (2) and with the general comments of WHO Night Noise Guidelines (3).

The relevant planning conditions were discharged with the above sound levels including:

- the implicit exceedance standard of $L_{Amax,FAST}$ 45dB 10-15 times per night
- the acceptance of these sound levels on balconies and roof terraces

No change in event noise is expected as the tracks and rolling stock are expected to remain as referenced under the scheme. No significant change in numbers is expected.

No change in ambient noise allowed for is expected to any great degree as the existing building design already takes account of 2028 values (i.e. 2014+15 years).

The following sections will consider whether the proposed scheme is likely to result in a change in sound exposure at fifth floor level and the effect of any other changes.

Adjacent Building 159-161 Iverson Road

The adjacent property had not been developed at the time of survey and design by Sol Acoustics.

The development planning permission was application reference 2013-7505-P and the acoustic report was:

- Aulos Acoustics Environmental Noise Assessment Report 13P282 JT R1260-188B 31 July 2014

The principal sound insulation performances recommended were:

- Rw37-40dB windows/external doors habitable rooms on most exposed north, south & flank elevations
- Rw33-37dB window/external doors Living Rooms north elevation may be adequate
- Rw45dB walls / non-vision areas
- Rw 40dB roof
- MVHR proposed

The sound insulation performance of the building envelope was determined, proved and discharged against planning conditions in the following reports:

- Applictn. 2014-6307-P NRG Consulting Report NA/IR/20140925-RK Oct 2014
- Applictn. 2016-0696-P Pace Consult Report PC-15-0257-RP1-REV-C April 2016

The principal sound insulation performances determined were:

- Walls Predicted Apparent Sound Reduction Index R'_w 57dB

The recommended requirements for window and ventilator performance based on an MEV system incorporating trickle vents were:

Table 5: Glazing and Ventilation Acoustic Performance

Facing	Level	Room	Glazing Rw + Ctr dB	Glazing Configuration	Ventilation Dnew dB	
West	All Floors	Living	Rw 34, -4Ctr dB	4 (20) 6	Dnew 41 dB	Corto 10
West	All Floors	Bed	Rw 34, -4Ctr dB	4 (20) 6	Dnew 44 dB	Medio 10
Railway	All Floors	Bed	Rw 39, -3Ctr dB	10 (12) 12	Dnew 44 dB	Medio 10
East	All Floors	Living	Rw 34, -4Ctr dB	4 (20) 6	Dnew 41 dB	Corto 10
East	All Floors	Bed	Rw 39, -3Ctr dB	10 (12) 12	Dnew 44 dB	Medio 10
Iverson	All Floors	Living	Rw 45, -4Ctr dB	12 (20) 8.8 Silence	Dnew 47 dB	Alto 10
Iverson	All Floors	Bed	Rw 45, -4Ctr dB	12 (20) 8.8 Silence	Dnew 47 dB	Alto 10

These are generally in line with the planning stage performance range.

These are also in line with the window and ventilator performances used for Existing Scheme 163 Iverson Road. The ventilator performances are more precise than described under the Existing Scheme ($D_{ne,w}$ 56dB ±2dB).

The Pace Consult report measured the achieved sound levels near completion which were:

	23.00-07.00h	LAeq,8h dB	LAmax,FAST 90th centile dB
MP1 Internal	Iverson Road	25	44
MP2 Internal	Railway	23	42
MP3 Internal	Railway	30	45
MP4 Internal	Railway	24	44
MP5 External	Iverson Road	63	N/A
MP6 External	Communal Garden	52	N/A

The achieved internal sound levels are in accordance with the planning condition criteria and the acoustic criteria for design including the prevailing criteria for individual noise events now.

The relevant planning conditions were discharged with the above sound levels including:

- the implicit exceedance standard of $L_{Amax,FAST}$ 45dB 10-15 times per night
- the acceptance of these sound levels on balconies and roof terraces

Proposed Scheme

The proposed rooftop extension comprises four flats with balcony / roof terraces to the south at fifth floor level.

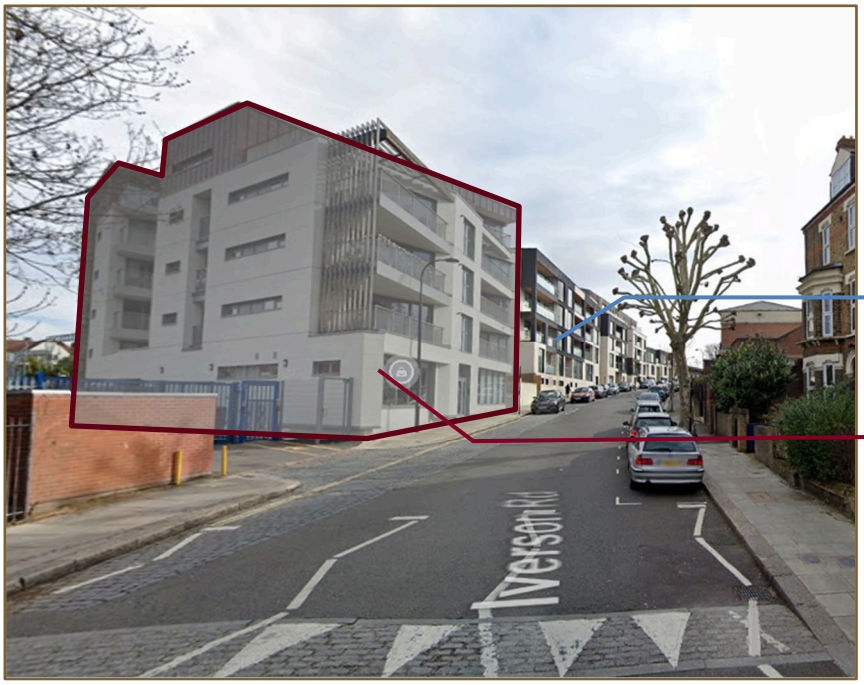
As with the existing scheme, the north-west corner of the building is the critical elevation and railway noise is the critical noise source.

The primary bedroom of unit 5-1 maintains a full view of the railway on the north-west and north-east elevation. It remains the “worst case” assessment point.

The north-east elevation otherwise maintains isolation of bedrooms from the railway but Living Rooms of 5-2 and 5-3 will be slightly exposed and flat 5-4 will be exposed on the north-east and south-east elevation. It is noted that substantial screening applies from the road to most areas of the fifth floor.

The south-west elevation contains the bedrooms of all flats. Screening from railway noise occurs, but as with previous models it is partial due to the long view of the railway.

Road traffic noise exposure must be taken into account on elevations nearest Iverson Road. Sound exposure is ostensibly the same as accounted for in the existing building or better. There is no substantive change in the view of the road to the south, but there is now substantive screening by 159-161 Iverson Road, as indicated by the following image [©Google].



The five storey sections of 159-161 Iverson Road and four to five storey sections of 163 Iverson Road provide substantive building screening from road traffic on Iverson Road.

Only rooms of flat 5-4 will have similar exposure to the fourth floor on Iverson Road, but this will not be worse than the existing building.

Further noise exposure consideration will be discussed below.

Associated Scheme

As discussed, the adjacent residential development at 159 -161 Iverson Road London NW6 2RB was subject to stringent noise control and planning conditions also. The scheme was permitted under application reference 2013/7505/P dated 21 February 2014 granted

The environmental noise report submitted for the planning application was as follows:

- 1160 JT R556-52 dated 15/12/2011 Aulos Acoustics

The report included initial worst case sound insulation performance requirements for the building envelope and ventilation scheme.

Design stage sound insulation measures were provided under application 2014/6307/P dated 14-01-2015 for discharge of conditions 6a and 15a.

The environmental noise report submitted for the planning application was as follows:

- NRG Consulting NA/IR/20140925-RK dated October 2014 (employs Aulos Acoustics & Sol Acoustics data from 163 Iverson Road. It should be noted there is no record of copyright request or consent).

Planning conditions 6b and 15B were discharged by application 2016/0696/P dated 11/05/2016. Internal sound levels were demonstrated in reports by Pace Consult:

- Pace Consult report PC-15-0257-RP1-REV-C dated 25th April 2016

At the time of planning discharge and measurement of 163 Iverson Road in February 2014 and before, 159-161 Iverson Road had not been built. Substantive building screening is expected to have been achieved from road traffic on Iverson Road.

Environmental Noise Model

To provide detailed evaluation of the change in conditions provided by the proposed rooftop extension, an environmental noise model has been generated for railway noise affecting the existing fourth floor and proposed fifth floor.

Road traffic noise is considered to be no worse than considered originally and is expected to be improved, based on screening provided by 159-161 Iverson Road.

The railway noise model has been generated using Datakustik Cadna-A software based on:

- Physical ground model used in 2011
- Existing drawings as built
- Proposed fifth floor drawings
- 159-161 Iverson Road drawings
- Track designation as defined by Network Rail, Thameslink and West Midlands
- Current network timetable
- Current knowledge and records of train types used

The baseline assumptions for rail movements are:

Platform	Train Count								
	EAST MIDLANDS			THAMESLINK			FREIGHT		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
1	-	-	-	92	22	36	-	-	-
2	-	-	-	94	27	30	-	-	-
3	82	22	14	86	30	8	-	-	-
4	84	25	14	91	28	26	-	-	-
Freight	-	-	-	-	-	-	14	5	29

Table 1 – Rail Traffic Data

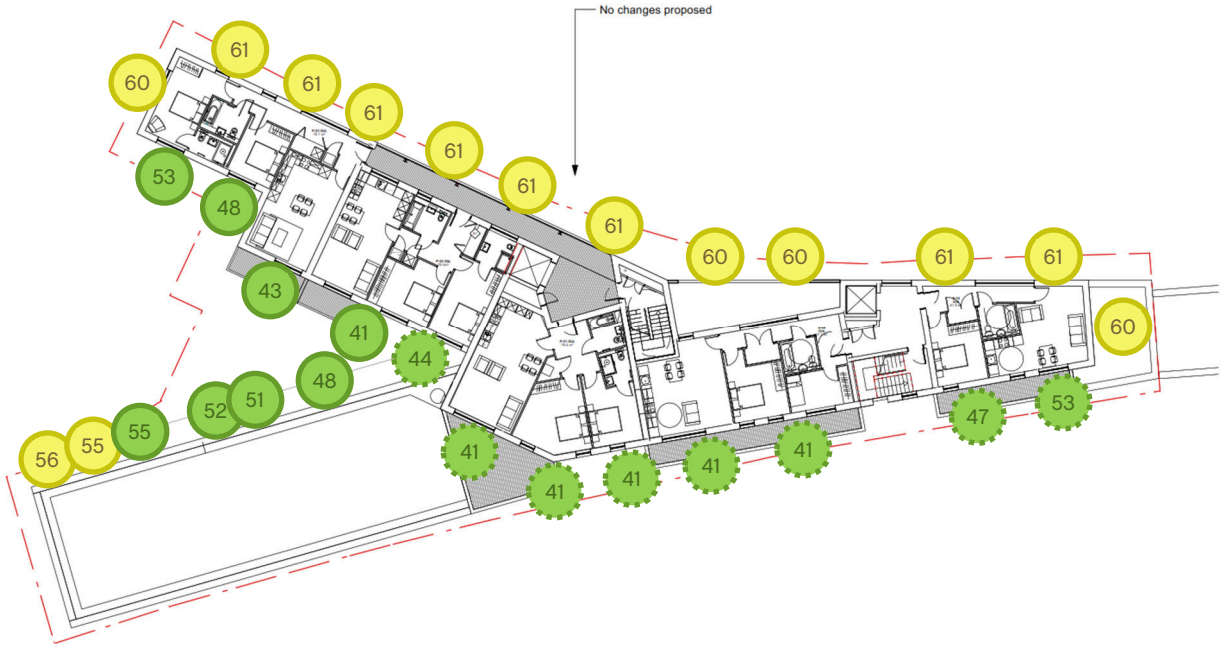
The calculation assumptions used are as follows:

- Railway: 'Calculation of Railway Noise' (CRN)
- Ground absorption set to 1;
- Order of reflection set to 1;
- All buildings façade absorption set to 0.1;
- Existing 1.8m high barrier (absorptive) alongside amenity space;
- Height of noise contour set to 14m and 17m.

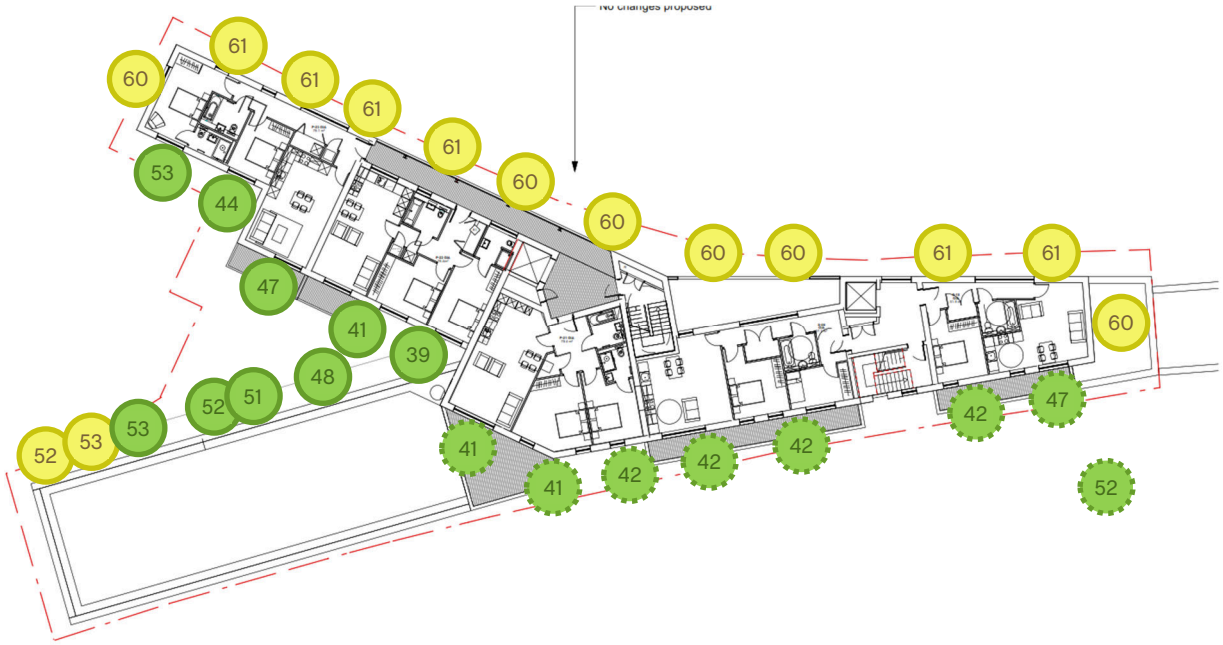
These are comparable to the original model and the movements identified by Sol Acoustics, which were partially based on confirmation with Network Rail.

Appendix C presents the results of the modelling and a series of figures for noise propagation contours and façade evaluations.

For reference, the summarised elevation sound levels [free field $L_{Aeq,16h}$ dB] for the original model at fourth floor were:



The summarised elevation sound levels [free field $L_{Aeq,16h}$ dB] for the current model at fourth floor are:



The summarised elevation sound levels [free field $L_{Aeq,16h}$ dB] for the current model at proposed fifth floor are:

Under the current model, there is negligible difference between fourth floor and fifth floor sound levels in the same lateral position.

There is negligible difference between the original model and the current model at fourth floor, despite the incorporation of current train operating company or national rail timetables [i.e. approximately 10-year period of passenger growth].

Night-time sound levels [free field $L_{Aeq,8h}$ dB] are 1dB less under the modelling calculation method.

Under current strategic plans for Thameslink and East Midlands train movement growth is expected to be limited.

There is limited information available on rail growth and most is in terms of passenger numbers or miles and freight tonnage. Whilst large increases are expected in both aspects, varying widely depending on the network, the presence of a demand does not equate to an increase in train numbers. Thameslink, for example, has been designed to allow for capacity over the long term without significant further increases in train numbers (e.g. operating trains at capacity, more full-length trains, etc.)

Based on the Network Rail Strategic Review for Control Period 6 there may be a 12% increase in passenger numbers. In some areas in the North-West and Midlands this may equate to substantial increases in train movements as modernisation and initiatives, such as Digital Railway, impact on the network. In London there is unlikely to be significant change, not least because much of the network has been modernised already or is at capacity. Allowance is made for a 5% increase in rail traffic movements in CP6 (2019-2024).

The anticipated increase on 2013, when the existing building assessment was completed, is not greater than 10% up to around 2028-2030. This is greater than allowed under the existing building design and equates to an approximate 1dB change in sound level.

To the best of our knowledge and understanding, there will be little or no available capacity in the London rail network for further train numbers, whether these be passenger or freight services.

Currently, there is no major strategic initiative at a functional stage which is able to increase the capacity of the existing network, although new schemes such as the Elizabeth Line (CrossRail), HS2 and East West Rail are expected to re-direct current passenger demand away from the existing network to a greater or lesser extent, so releasing current capacity.

Consequently, train movements past 2030 are unlikely to change significantly more than allowed unless substantive long-term initiatives and infrastructure changes are implemented.

A 10% change in railway train movements is allowable in the long term. This equates to a 0.4dB change. The original design included a 5% re-allocation of mainline trains to a relief line near the site, which equates to a 0.2dB increase in sound level.

The summary of key sound levels on the most exposed elevation

Floor	**Current**	**Day** $L_{Aeq,16h}$	**Night** $L_{Aeq,8h}$	**Future**	**Day** $L_{Aeq,16h}$	**Night** $L_{Aeq,8h}$	**Current – Future Difference**	
Fourth Floor		61	60		62	61	**+1**	dB
Fifth Floor		61	60		62	61	**+1**	dB
Difference		**0**	**0**		**0**	**0**		**dB**

In the context of railway noise and the environment at 163 Iverson Road, there is a negligible and unnoticeable change in sound level expected:

- Between fourth and fifth floor
- Between Current and Future

No increase in acoustic design allowances for the sound insulation performance of the building envelope are required due to railway sound.

There is no necessity for a detailed environmental noise survey in the light of negligible change in sound exposure. The change in height and form of the roof and fifth floor will not alter the noise exposure to a noticeable extent.

Current acoustic performance requirements may be replicated in the Proposed Scheme. This will ensure residential amenity is protected and maintain consistency between dwellings in a high-density residential building.

Road Traffic Noise

Road traffic noise from Iverson Road affects the southern elevations of the building.

The original design of the existing building has been based on measurements by Sol Acoustics in 2013.

External sound levels at or close to the elevation have now been measured on several different occasions:

Year	Position	Day $L_{Aeq,16h}$	Night $L_{Aeq,8h}$	Night L_{Amax}		Time Weighting	
2011	-	-	-	71-89	Aulos Acoustics	SLOW	Interference
	-			71-81	Aulos Acoustics	SLOW	Interference
2013	2	63	59	71-92	Sol Acoustics	FAST	Open Site; basis of design
2014	159 IR	63	58	46-93	NRG Consulting	FAST	Derived
	159 IR	65	55	78	NRG Consulting	FAST	Derived; basis of design
2016	159 IR MP1	[29]	25	44	Pace Consult	Internal	90 centile Lmax
2016	159 IR MP5	[64]	60	[79]	Pace Consult	External	Balcony; façade corrected
	-						

[implied]

Road traffic forecast RTF18 data predicted a reference scenario increase in London road traffic 2015-2030 of 18.8% growth and 2015-2035 of 24.3% growth [all roads; all vehicles; not trip adjusted]. The model on which the forecast is based is acknowledged to overpredict London road traffic forecasts due to substantive behaviour differences in London (e.g. due to congestion, availability of extensive public transport system, age of populace, parking availability, etc.).

The predicted change in road traffic sound level is consequently no greater than:

- 2015-2030 +0.7dB
- 2015-2035 +0.9dB

It should be noted that the above are for All Roads. Principal A roads and Minor Roads show slightly lower growth rates in the main (and, so, sound levels) 2015-2030. Projection of five-year growth rates for London [Figure 34 of RTF18] show lower growth rates (2015-2030 of 18.0% and 2015-2035 of 22%) before taking account of road type.

The allowance included within the design of the existing building is 0.97dB based on standard road traffic projection. The design includes for a pessimistic growth rate of 25% 15-year, which exceeds that expected by the current National Traffic Model in London significantly.

Further confirmation is provided by the specific five-year growth rate between 2030-2035 of 4.6% [Figure 34 of RTF18] which equates to 0.2dB additional sound level difference.

The above is not intended to represent a transport assessment, but as general confirmation that the allowances included in the existing design are robust for the current period.

There is negligible difference in sound level due to the allowances made in the design (approximately 2015-2030, nominally 2013-2028) and those for the current design (approximately 2020-2035).

The original performance allowances for controlling road traffic noise in the Existing Scheme are robust for the Proposed Scheme and are expected to exceed the actual road traffic growth.

Design Basis

The proposed design basis is the existing building.

The proposed building envelope will maintain sound insulation performance consistent with the existing building.

The recommended minimum sound insulation performances are, as follows therefore:

The building envelope sound insulation performance approved in the Sol Acoustics report

Window sound insulation performance shall achieve a minimum sound reduction index as follows:

Glazing Configuration	**Minimum Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)**						
	63	125	250	500	1k	2k	4k
Allowing some exceedances of LAmax,FAST 45dB	23	27	30	39	43	43	50

Approximately R_w 42(Ctr-6) ±2dB

Wall & Cladding Configuration	**Minimum Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)**						
	63	125	250	500	1k	2k	4k
Wall Type A1 External Brick (·385mm)	33	43	43	61	75	75	75
Wall Type A2 External Timber (·375mm)	26	33	40	52	60	67	72
Roof of External Cladding	26	33	40	52	60	67	72

The actual performance is expected to be limited to minimum 62dB at octave band frequencies above 1kHz due to the inherent limitations of in-situ sound insulation performance.

The approved performance for any acoustic ventilation system in the most exposed locations, including high performance acoustic vents with MEV or ducted vents with MVHR or centralised MEV are:

Trickle Vent Specification	**Minimum Element-Normalised Level Difference- D_{ne} (dB) @ Octave Band Centre Frequency (Hz)**						
	63	125	250	500	1k	2k	4k
High specification trickle vent 2500mm2 max. per habitable room (e.g. Greenwood Airvac MA3051)	40	46	46	49	56	66	64

Approximately $D_{ne,w}$ 56 ±2dB

The above applies to elevations facing the railway or with substantial views of the railway:

- North
- West
- East

Based on the acoustic conditions found at 159-161 Iverson Road, the south elevation may have lower performance acoustic ventilators.

The actual minimum Weighted Normalised Element Level Difference required on the Iverson Road elevation is $D_{ne,w}$ 49dB.

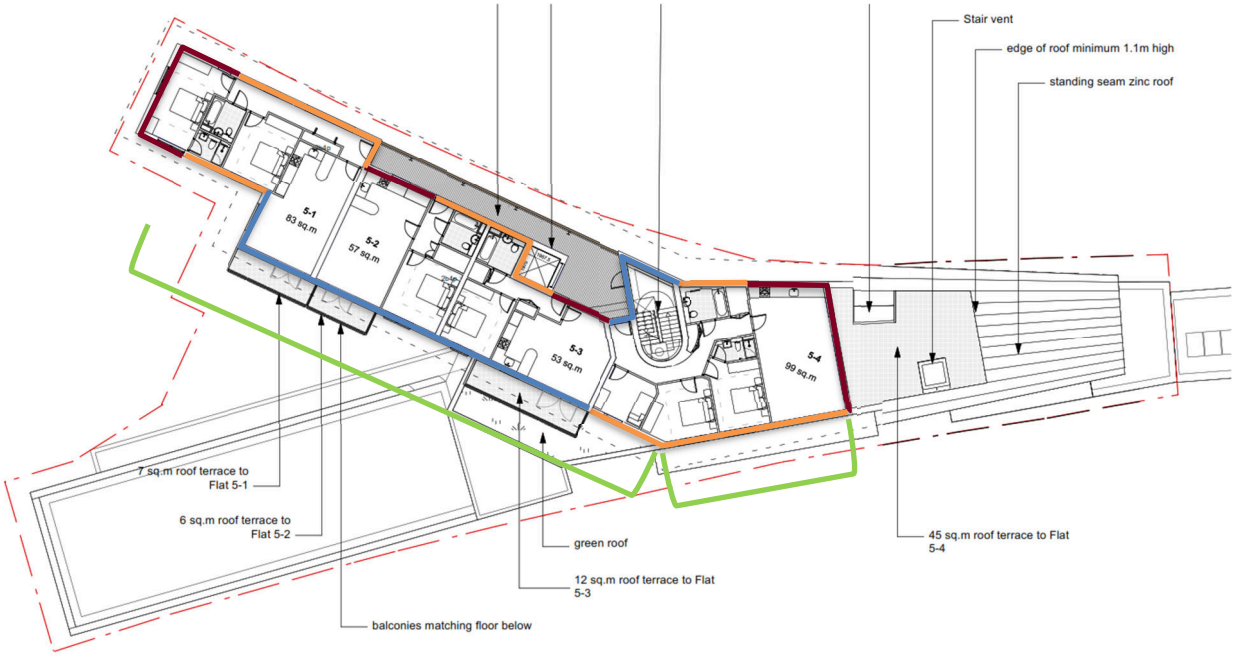
The recommended distribution of ventilator performance is as follows:

$D_{ne,w}$ 55dB single unit; 2500mm^2 nominal

$D_{ne,w}$ 49dB single unit; 2500mm^2 nominal

$D_{ne,w}$ 44dB single unit; 2500mm^2 nominal

Recommended zone of ventilation for inlets and exhausts if ducted MEV or MVHR are used. $D_{ne,w}$ performance equivalent to highest for habitable rooms in each flat on that elevation (either 44dB or 49dB).



The internal floors and wall will maintain sound insulation performance consistent with the existing building. These are addressed in 'Internal Sound Insulation' below.

By ensuring consistency is maintained the same quantitative and qualitative standards of acoustic environment will be provided for future residents and existing residents.

In general terms, residents of either property would be able to experience a similar noise climate in proposed or existing properties.

Consideration of the railway and road traffic noise climate above shows there is expected to be no significant variation in noise climate between the due to either modelled (and projected) railway noise or previously measured (or projected) road traffic noise.

Provided an equal or better standard of sound insulation is achieved, the internal acoustic environment will be consistent with the existing building, which was deemed acceptable under current planning permission and during the discharge of planning conditions.

The implementation of the existing design allowances as above will ensure sound levels are consistent with the existing building and with previous planning approvals for both 163 Iverson Road and 159-161 Iverson Road.

The internal sound levels would be expected to achieve the same standard of internal sound level day and night as the existing building, both now and in the future. These would comply with the same internal sound level criteria namely:

Activity	Location	07:00 to 23:00	23:00 to 07:00	
Resting	Living room	35 dB $L_{Aeq,16hour}$	-	BS8233 Table 4
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-	BS8233 Table 4
Sleeping)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$	BS8233 Table 4
(daytime resting			45 dB $L_{Amax,FAST}$	Aulos Guideline Actual event noise 10-15 times per night; WHO guidelines ProPG noise level guidelines

Table 6 – Internal Sound Level Criteria

The internal residential amenity would be reasonable and acceptable for future residents.

External Amenity

The external sound levels are expected to be similar to or better than for the existing scheme sound levels.

South west elevation balconies are expected to experience sound levels $L_{Aeq,16h}$ 50-55dB at worst in a seated position, and lower than 50dB for railway noise alone.

South elevations are expected to experience sound level $L_{Aeq,16h}$ 55-60dB at worst, but there are no balconies proposed at this point.

The east terrace of Flat 5-4 is expected to experience sound level $L_{Aeq,16h}$ 58-60dB and lower in seated positions, by approximately 3-5dB. Road traffic noise is not expected to contribute more than 1dB to the railway sound level due to substantial building screening.

A resident of Flat 5-4 should be able to find quiet seated areas within the roof terrace where experienced sound levels will be equal to or below the normal upper limit for outside space (i.e. $L_{Aeq,16h}$ 55dB).

These are reasonable and acceptable sound levels in the context of external urban balconies and terraces. They are consistent with the existing scheme and prevailing guidance, including BS8233.

The existing and proposed scheme are now screened by 159-161 Iverson Road so the proportion of road affecting the elevations of the northern wing of the development is significantly reduced.

No external amenity areas are expected to experience sound exposure as great as occurs immediately adjacent to Iverson Road because these areas are:

- set back from the road elevation

- in the free field environment at roof level (i.e. not reflected between buildings at lower level)
- screened from the road surface by the building or balcony screens

Residential amenity will be protected to the quality expected for elective amenity spaces in an urban environment. The standard achieved will be equal to or better than achieved for the existing building.

Internal Sound Insulation

The construction of rooftop extensions on existing residential buildings introduces a separating floor where there was not previously one.

The large roof area is removed so the existing residents do benefit from substantially reduced sound exposure to external noise, but the new floor should maintain a reasonable standard of sound insulation.

The recommended minimum sound insulation performance is as follows:

- Separating Floor - Airborne $D_{nT,w}$ +C_{tr} 48dB
- Separating Floor - Impact $L_{nT,w}$ 59dB

These are 5dB better than the requirements for residential sound insulation required under the Building Regulations Approved Document E for conversions (i.e. dwellings formed by a material change of use under Regulation 5 of The Building Regulations).

There is a functional and practical limitation on achievable sound insulation performance when converting existing dwellings which will affect achievable sound insulation. The design and performance are reliant on the existing structure and sound transmission paths, which can be weaker than for a complete building.

Approved Document E reflects the degree to which it is reasonable to expect a reduced performance and limits this to a 2dB reduction.

Wherever practical and feasible, the design will aim to eliminate this natural reduction in performance.

The recommended minimum sound insulation performance for party walls at fifth floor is as follows:

- Party Walls – Airborne $D_{nT,w}$ +C_{tr} 50dB

These are 5dB better than the requirements for residential sound insulation required under the Building Regulations Approved Document E for new buildings (i.e. purpose-built dwellings).

In general terms, although the fifth floor is technically dwellings formed by a material change of use, these types of flats tend to be treated as new-build dwellings by Building Control Bodies.

The design of the fifth floor has not been developed at this stage but is likely to be a light gauge steel frame over the existing roof frame.

Provided there is separation of the framed structure from the existing structure by either separated structural support of each flat or resilient isolation bearings then sound insulation performance can be optimised.

Example of a typical floor construction for each flat:

Element	Construction
Floating floor	Cellecta ScreedBoard® 28 or equal and approved; underfloor heating will require specific screedboard selection.
Floor decking	18mm thick (min) wood-based board, density 600 kg/m^3 (minimum)
Joists	254mm (minimum) deep metal joists
Isolation	Resilient strip isolation bearing for dwelling sound insulation
Absorbent layer	100mm (min) mineral wool quilt insulation (20-40 kg/m^3) between joists retained by proprietary mesh
Cavity	300mm between underside of decking and upper face of ceiling
Interstitial layer	Optional interstitial layer (e.g. 10mm (min.) cementitious board over existing structure / below isolation
Ceiling	Existing ceiling below if retained. Close all downlighter openings with fire-acoustic covers. Seal all services penetrations

The expected sound insulation performance when constructed optimally is

- Separating Floor - Airborne $D_{nT,w}$ +C_{tr} 53-55dB
- Separating Floor - Impact $L_{nT,w}$ 52-54dB

Sound insulation will improve if constructing over the existing warm roof system or flat, continuous sealed deck.

Sound insulation will improve with an interstitial layer.

Example of a typical wall construction for each flat:

Element	Construction
Wall lining	Two or more layers gypsum-based board (minimum total nominal mass per unit area 25 kg/m2) both sides. All joints staggered and sealed.
Steel frame	75mm (minimum) studs both sides; independent and no cross-bracing; structural ties shall be minimised and acoustic isolated ties.
Wall width	250mm (minimum) deep; between wall linings
Service Zones	Options apply but generally comply with wall width if feasible
Isolation	Resilient strip isolation bearing for some walls may be required; resilient head detail may be required.
Absorbent layer	One layer 75mm (minimum) unfaced mineral wool batts, (density 10-40 kg/m3)
Interstitial layer Sheathing	Optional interstitial / sheathing layer may be required to one side for security or structural purposes and is permissible
Thermal insulation	Full fill insulation is permissible only if using unfaced and resilient mineral wool as described above

The expected sound insulation performance when constructed optimally is

- Separating Wall - Airborne $D_{nT,w}$ +C_{tr} 54-56dB

Sound insulation will improve if isolated at the head and foot of the wall.

Sound insulation will improve if the ceilings are resiliently hung on either side of the wall.

Critical flanking and external wall details will apply to both the wall and floor above.

In general terms, construct in accordance with the Robust Details Handbook for details E-WS-5 (wall) and E-FS-3 (floor) and according to the construction above.

Uncertainty applies in all sound insulation estimated performance as not all buildings are the same. For the purposes of the above, uncertainty of ±3dB shall apply.

Under normal circumstances and optimal construction the above would be better than the minimum sound insulation performance recommended and are expected to be better than the new-build performance of Approved Document E.

Rain Noise Control

Any sections of profiled metal roof or cladding will require integrated rain impact noise damping to any metal sheet as well as layered insulation and resiliently hung ceilings below.

A suitable damping layer may be Sound Reduction Systems Raincheck but a substantial coverage will be required of 40% minimum to flats.

Insulation is normally a combination of high (65-150kg/m^3 density) and medium density (36-65kg/m^3 density) mineral wool in several layers with an interstitial mass layer exceeding 10-12kg/m^2 .

The ceiling below should be two layers of gypsum-based board (minimum total nominal mass per unit area 25 kg/m2) both sides. All joints staggered and sealed. The ceiling must be either independent or decoupled by resilient hangers [not resilient bars / MF bars].

Sound levels during heavy rain should not be more than 25 dB above the appropriate indoor ambient noise level wherever practicable:

- $L_{Aeq,T}$ 60dB daytime
- $L_{Aeq,T}$ 55dB night-time

where T is the effective period of rainfall not the whole daytime or night-time period

“Heavy” rainfall is defined in BS EN ISO 140-18:2006 Acoustics. Measurement of sound insulation in buildings and of building elements. Laboratory measurement of sound generated by rainfall on building elements.

Manufacturer’s data is normally available for different roof types and shall be calculated based on tested data only. All data shall be for the unfurnished room adjoining the roof or cladding area in question.

Conclusions

Aulos Acoustics has completed an investigation of the environmental noise expected of the application site at Rooftop Extension 163 Iverson Road, London NW6 9RB.

The existing building has a substantial acoustic performance and the rooftop extension needs to maintain consistent external sound insulation.

Environmental Noise

The noise exposure of the existing building and the neighbouring residential property at 159-161 Iverson Road has been reviewed to identify the requisite performance requirements.

Provided these performance requirements are not affected significantly by future growth in road or rail traffic or by altered noise exposure at fifth floor level, the proposed flats may have the same or similar sound insulation.

It has been shown that additional growth in railway and road traffic will not lead to significant change in noise exposure, being limited to 0.5dB or less upon that allowed within the existing building up to approximately 2035.

Environmental noise modelling of the railway under original and current rates shows negligible difference between existing fourth floor and proposed fifth floor sound levels. The proposed fifth floor will not change fourth floor sound levels.

Inclusion of 159-161 Iverson Road in the environmental model will ensure the amenity areas are better screened from road traffic noise than for the approved existing scheme.

The difference between current and future sound levels is limited to +1dB or less based on a rounded value. Such a difference is negligible and within the ability of the original sound insulation scheme to ensure reasonable internal sound levels.

Internal Sound Levels & Amenity

The current sound insulation allowances for the building envelope are appropriate for the proposed rooftop extension. These have been reiterated in 'Design Basis' above for the details approved under previous planning applications.

Similarly, the ventilation scheme must enable an alternative means of ventilation to open windows. Ventilation openings shall be placed in the recommended elevation zone to ensure a medium attenuation performance is adequate [i.e. $D_{ne,w}$ 44-49dB as described in 'Design Basis'].

The achievable internal sound levels are, therefore:

Activity	Location	07:00 to 23:00	23:00 to 07:00	
Resting	Living room	35 dB $L_{Aeq,16hour}$	-	BS8233 Table 4
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-	BS8233 Table 4
Sleeping)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$	BS8233 Table 4
(daytime resting			45 dB $L_{Amax,FAST}$	*Aulos Guideline* Actual event noise 10-15 times per night; WHO guidelines ProPG noise level guidelines
				Achievable Internal Sound Level

These are understood to comply with LB Camden requirements and are consistent with the existing building and the planning approval of details for the existing building.

External Amenity

The external sound levels on balconies and the roof terrace are expected to be equal to or below 60dB during the day - on the south-west elevation these are likely to be below 55dB during the day.

Sound levels are reasonable in the context of elective amenity areas in an urban environment.

Seated height sound levels on the roof terrace of Flat 5-4 will tend to be equal to or lower than 55dB due to screening.

All sound levels are expected to be below those for the existing buildings at 163 and 159-161 Iverson Road external balconies (both the predicted and measured sound levels).

Consequently, external amenity is reasonable and acceptable in comparison to the approved, existing buildings.

Internal Sound Insulation

Internal sound insulation has been reviewed and performance targets defined which are 5dB better than those required under the Building Regulations.

A typical construction for lightweight steel frame rooftop extensions has been reviewed, which would exceed these performance requirements and, probably, exceed new-build requirements.

Detailed design of the internal sound insulation is required to ensure the conjunction with the existing roof and fourth floor is adequately addressed.

NB: reverberation control will be required in communal areas to optimise sound insulation between flat access doors.

Roof and Cladding Rain Noise

Rain noise control objectives and general design measures have been defined for areas of metal cladding now proposed.

Sound damping and sound insulation will be required to offset the effect of profiled metal impact sound due to “heavy” rain.

Achievable Sound Levels

The proposed rooftop extension at 163 Iverson Road would be expected to provide a reasonable and acceptable standard of residential amenity for future and existing residents.

Residential amenity would be protected by providing:

- High sound insulation performance to the building envelope
- Moderate to high sound insulation for ventilation scheme
- High sound insulation performance between flats
- Control of noise in amenity areas
- Control of rainfall noise below new metal roofs or cladding

The proposed standard of acoustic treatment will require detailed development but is expected to provide a residential environment that is both reasonable and consistent with the existing building. The proposed acoustic treatment is based on the details approved under planning approvals for the existing building.

The recommended design basis is capable of protecting residential amenity of both existing and future residents.

Consequently, the proposed scheme is expected to comply with the requirements of the national, London and local policy relating to noise and ensure:

- Significant effects on amenity are avoided
- Effects on amenity are minimised to the Lowest Observed Adverse Effect Level [LOAEL]

James Tomalin MIOA

Appendix A- Glossary

Term	Description	
Sound	Physical oscillation of air or other material which is normally detected by the ear as a complex, time-varying and detailed description of the environment around the listener. Interpretation and subjective filtering of sound by the brain results in comprehension, emotional response and physical reactions to sound. Sound can also be detected by touch when transmitted in a solid medium and be perceived as motion at very low frequencies (i.e. vibration).	
Noise	Generally defined as unwanted sound, which as a highly subjective description is subject to wide interpretation. Some describe noise as harsh or dissonant conditions, but such descriptions tend to be value-based and will vary from person to person.	
Ambient Noise	The noise climate heard over a period of time due to all normal sources, in the absence of extraneous or atypical sounds. Used to describe noise in the absence of the introduced sound, generally.	
Ambient Noise Level	Describes the average noise level of the ambient noise over a stated period of time, e.g. hourly noise	
	Parameter: A-weighted Continuous Equivalent Sound Pressure Level determined over the time period T. Expressed in decibels / A-weighted decibels	$L_{eq,T}$ or $L_{Aeq,T}$ dB(A) or dB
Note:	Used in the reports generically to represent both current noise climate and noise level of vehicle noise to encourage direct comparison	
Leq,T	the notionally-steady sound level having the same acoustic energy as the time varying sound pressure level over the same period	
Background Noise	The underlying noise climate in the absence of an introduced or extraneous noise. Describes the quieter periods in the noise climate.	
Background Noise Level	Describes the “average minimum” level of the background noise climate over a stated period of time	
	Parameter: A-weighted Statistical Index 90% Sound Pressure. The quietest decile of the sound pressure levels or level exceeded for 90% of the time period, T Expressed in decibels / A-weighted decibels	$L_{90,T}$ or $L_{A90,T}$ dB(A) or dB
Acoustic screening	Physical barrier to sound formed by fence, wall, building or other structure, which has the effect of reducing the sound transmitted.	
Individual Event Noise	The noise of a distinctive event with the varying noise climate, usually a transient activity, such as a vehicle pass-by, aircraft flyover or similar, rather than an isolated impulsive noise.	
Event Noise Level	Highest noise level during the event as measured under particular conditions of time-weighting	
	Parameter: A-weighted Maximum Sound Pressure Level with FAST or SLOW time weighting Expressed in decibels / A-weighted decibels	$L_{Amax,FAST}$ or $L_{Amax,F}$ $L_{Amax,SLOW}$ or $L_{Amax,S}$ dB(A) or dB
Event Frequency	The number of times an individual event of a similar type occurs in the time period under consideration. Important descriptor as the impact of Individual Event Noise is dependent on changes in both level and event frequency.	
Time Weighting	The sampling rate at which a sound level meter measures the time-varying sound pressure level: originally described how fast the needle moved on analogue meters. Ensures the measurements respond to the type of noise source accurately and are representative. FAST = 125ms sampling rate = 480 samples / minute SLOW = 1s sampling rate = 60 samples / minute	

Appendix B - References

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Figure E21086/

Figure	Development	Period	Contour Height	Field	Description	Level		
NM3	Existing	Daytime	14m	Free Field	Existing Top Floor	4	Current railway; existing scheme	Shows baseline sound level of existing scheme using current rail data
NM4	Existing	Night-time	14m	Free Field	Existing Top Floor	4	Current railway; existing scheme	
NM5	Proposed	Daytime	17m	Free Field	Proposed Extension	5	Current railway; proposed scheme	Shows predicted sound of proposed extensions using current rail data
NM6	Proposed	Night-time	17m	Free Field	Proposed Extension	5	Current railway; proposed scheme	
NM7	Proposed	Daytime	14m	Free Field	Existing Top Floor	4	Current railway; proposed scheme	Shows effect of proposed extension on existing top floor
NM8	Proposed	Night-time	14m	Free Field	Existing Top Floor	4	Current railway; proposed scheme	
FE1	Proposed	Daytime	14m	Free Field	Existing Top Floor	4	3D Façade evaluation	Presents outline of façade sound levels on a wireframe for each floor
FE2	Proposed	Daytime	17m	Free Field	Proposed Top Floor	5	3D Façade evaluation	
MC1	-	-	1.5m; 5m	Free field	Ground / First / Second Floor	0,1,2	Comparison of modelled low level sound levels to measured sound levels	

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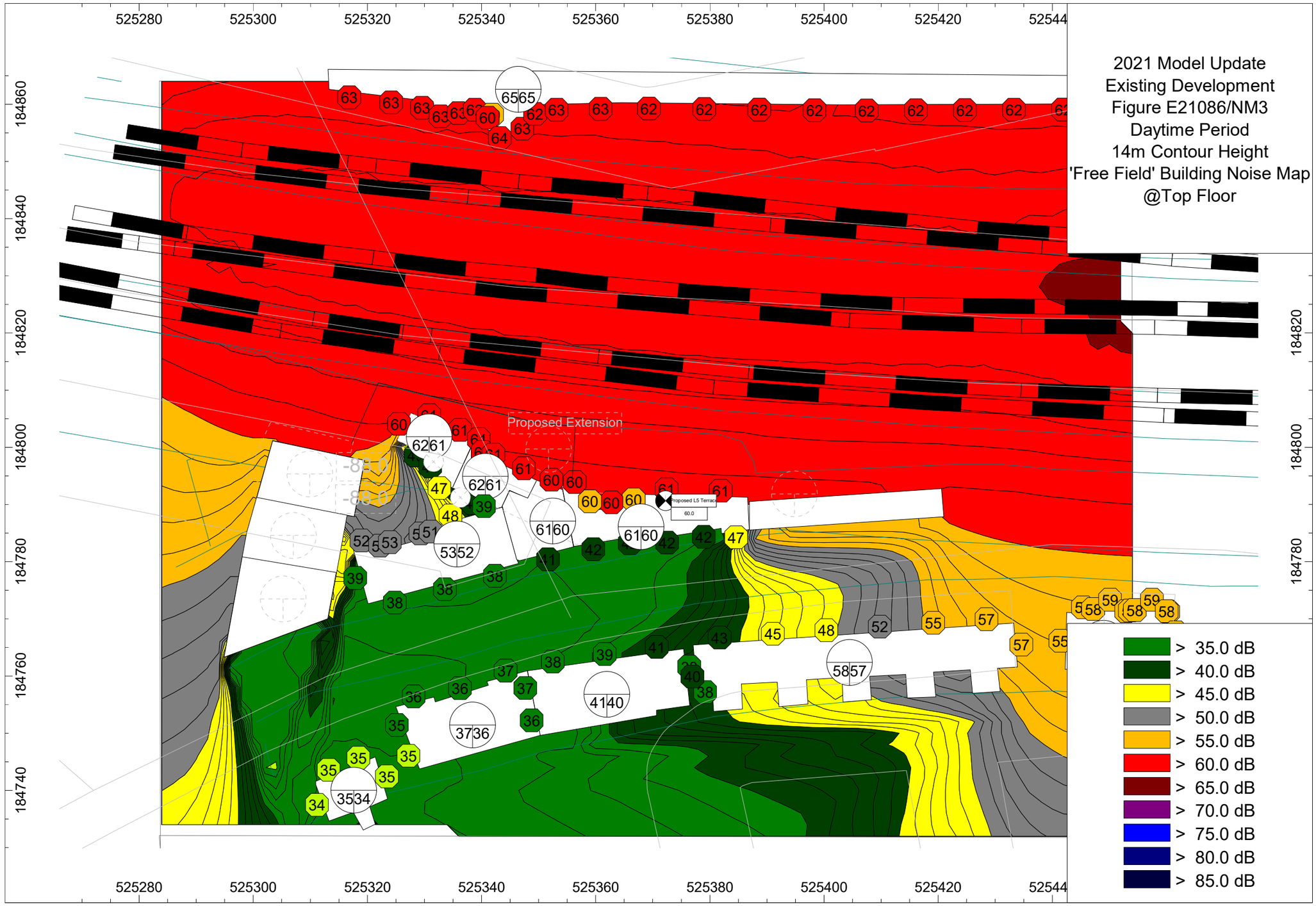

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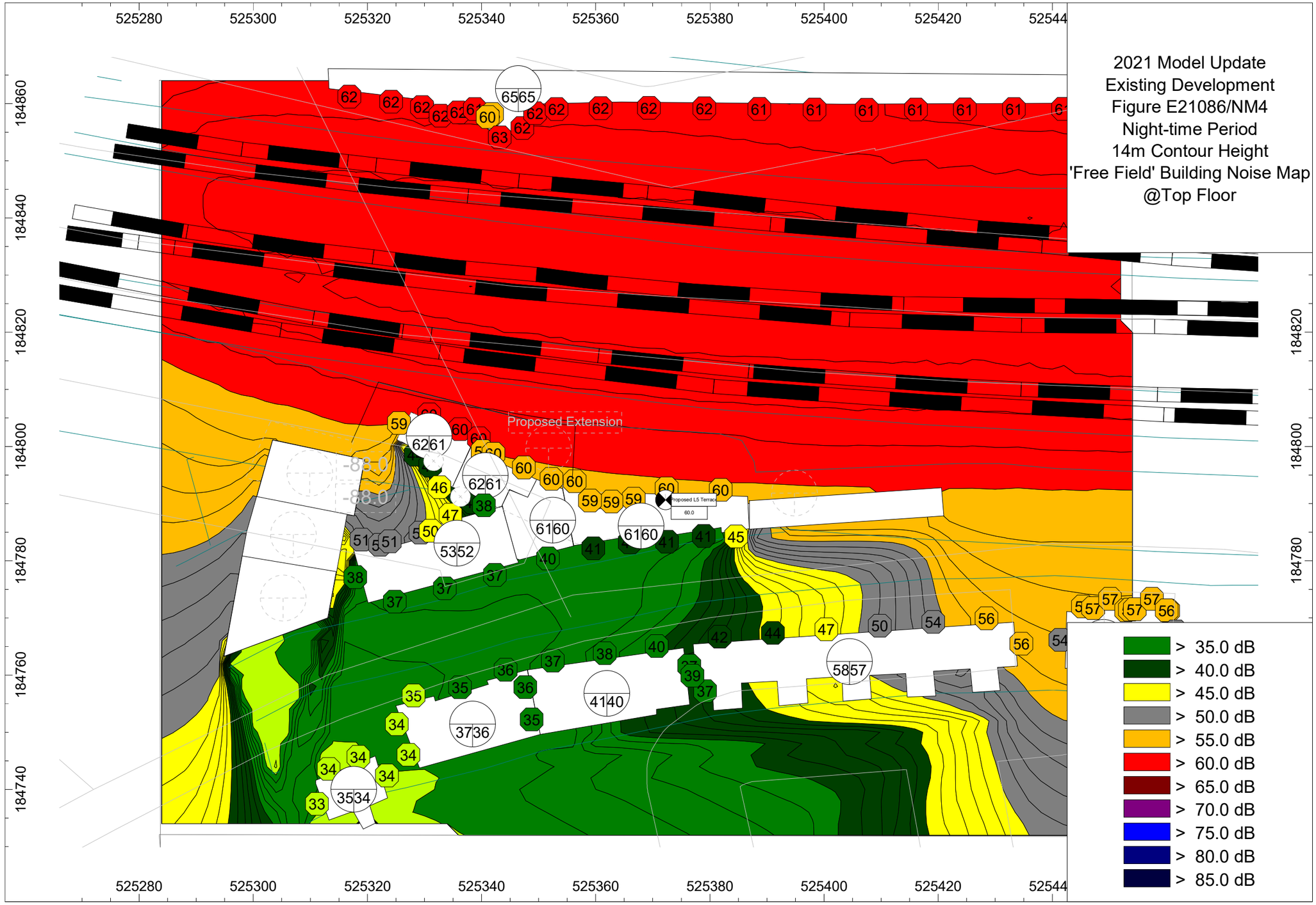

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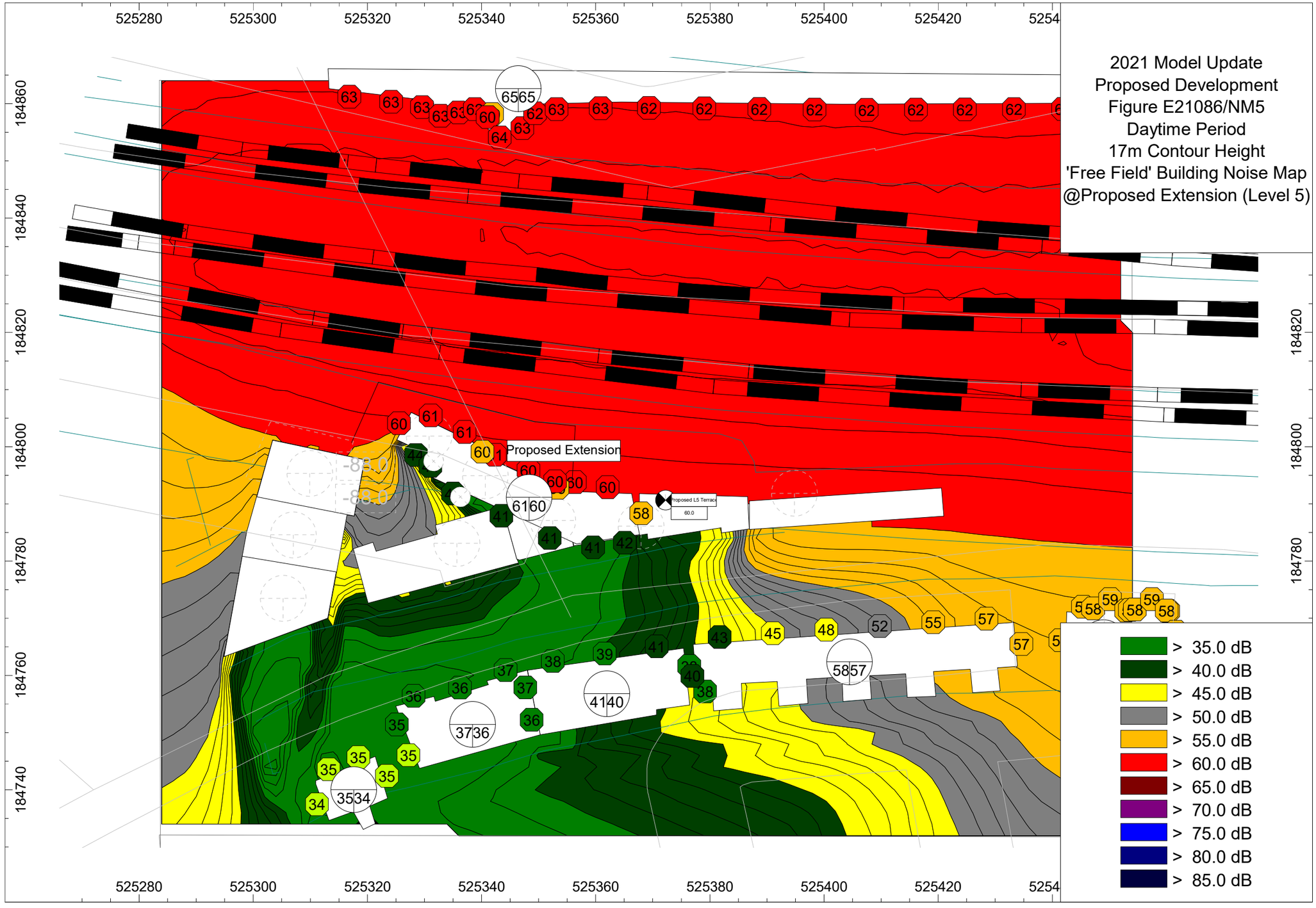

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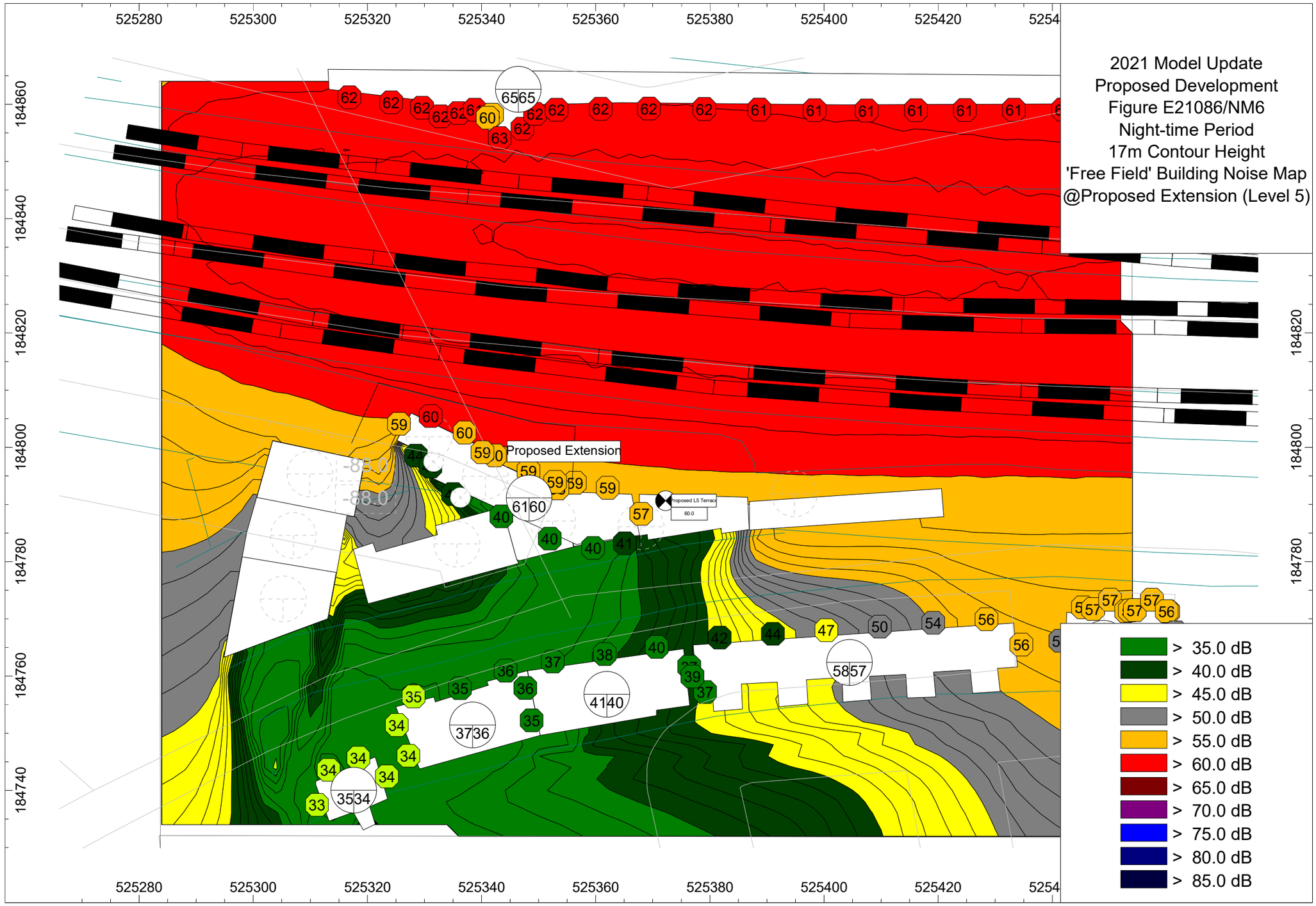

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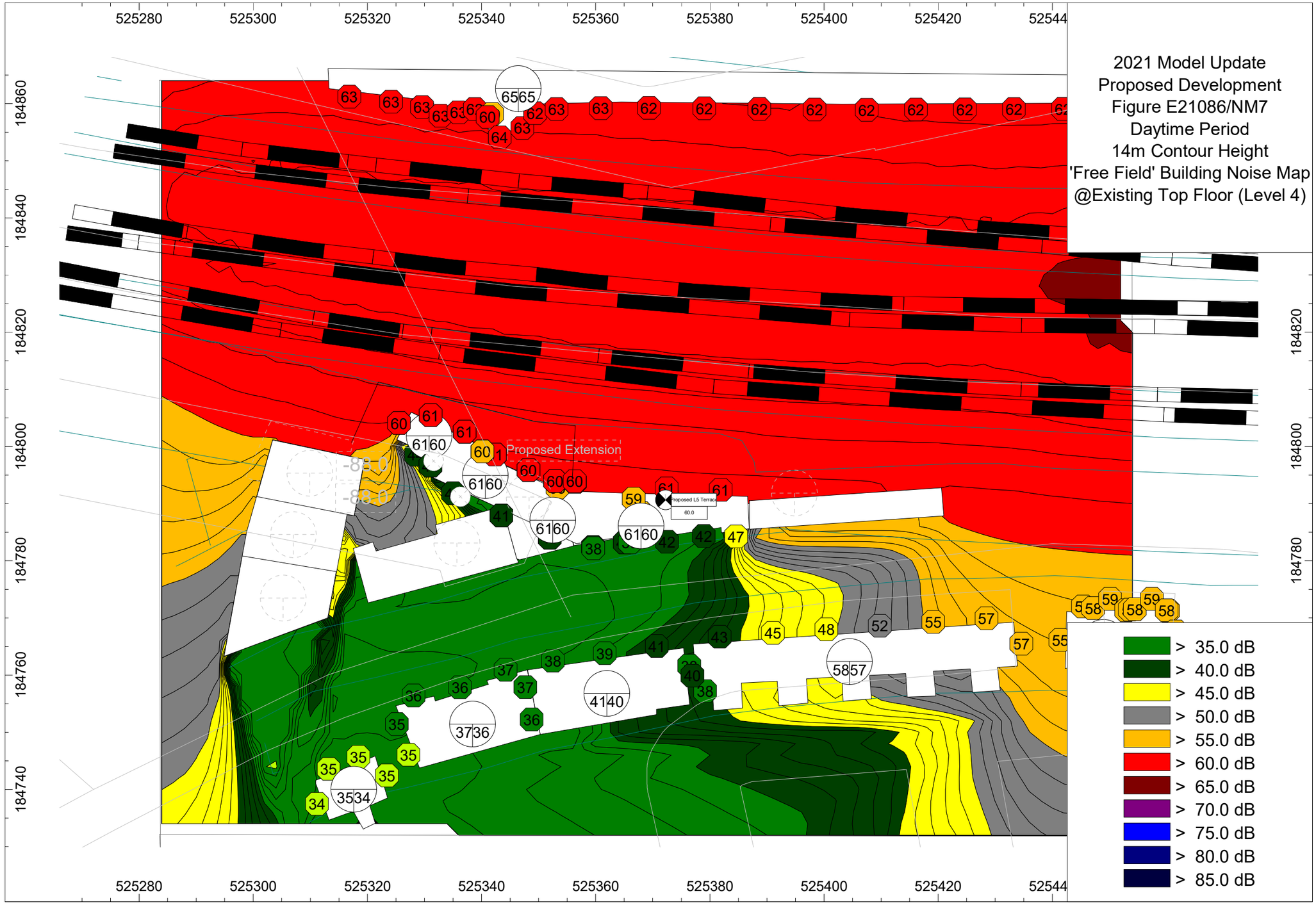

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2021 Model Update
Proposed Development
Figure E21086/NM8
Night-time Period
14m Contour Height
'Free Field' Building Noise Map
@Existing Top Floor (Level 4)

Proposed Extension

Proposed L5 Terrace
60.0

525280 525300 525320 525340 525360 525380 525400 525420 52544

184860 184840 184820 184800 184780 184760 184740

> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB
> 85.0 dB

Figure E21086/FE1 - Proposed Development – Existing Top Floor (Level 4) Façade Evaluation

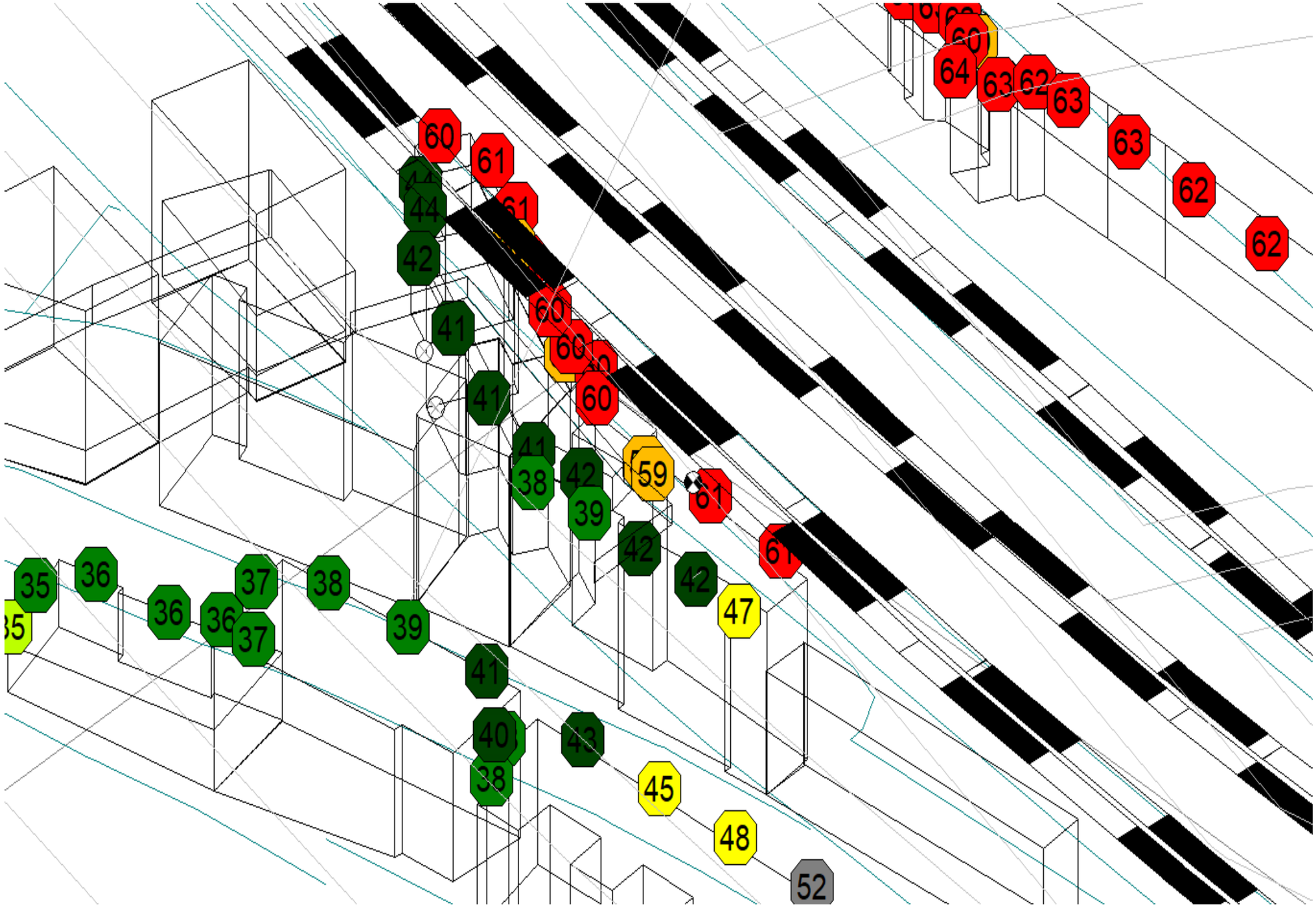

Figure E21086/FE2 - Proposed Development – Proposed Extension (Level 5) Façade Evaluation

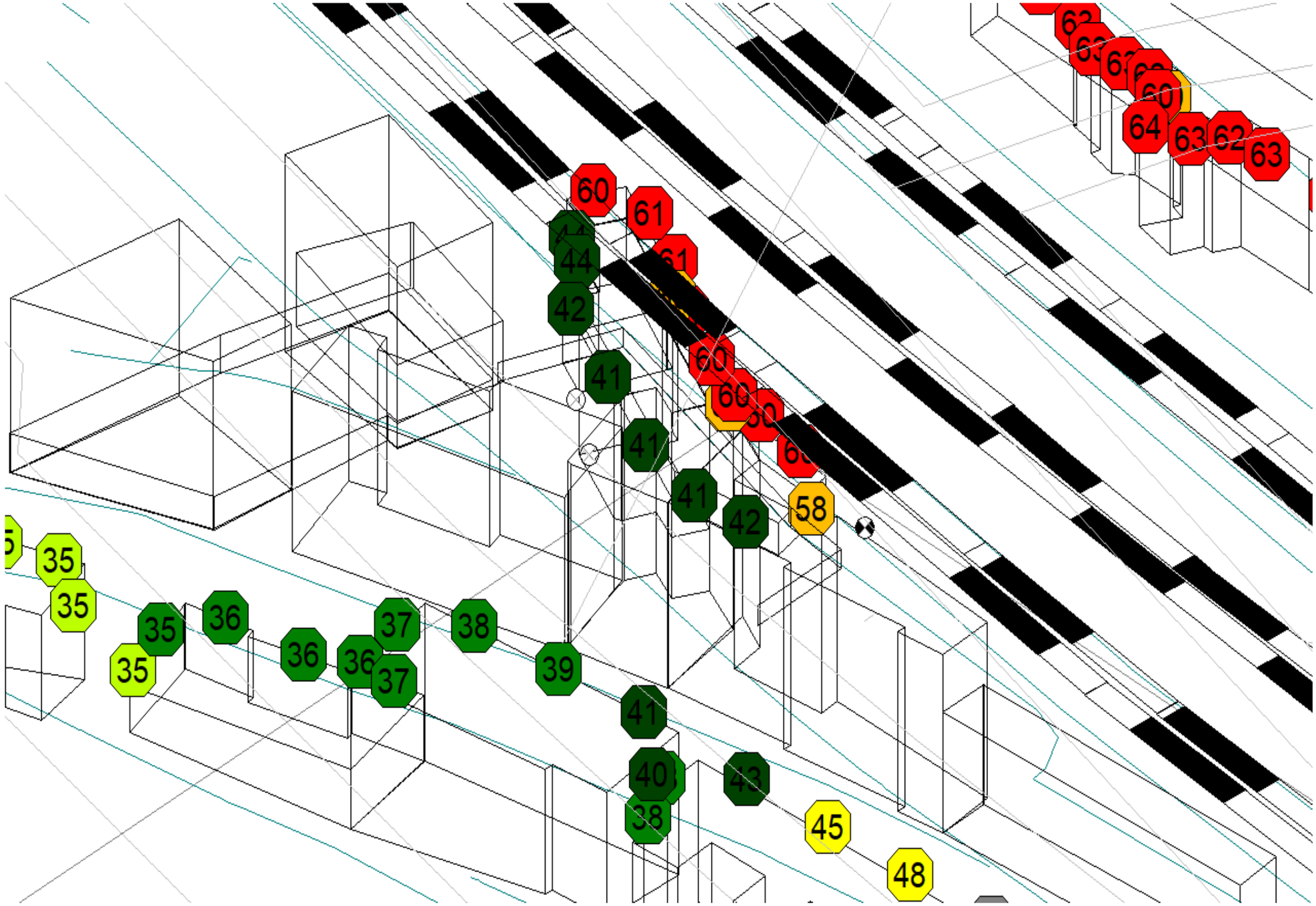

Figure E21086/MC1 Comparison to Measurement Positions

Ground Level & “First Floor” results at Sol Acoustics reference positions P1 and P4 as follows:-

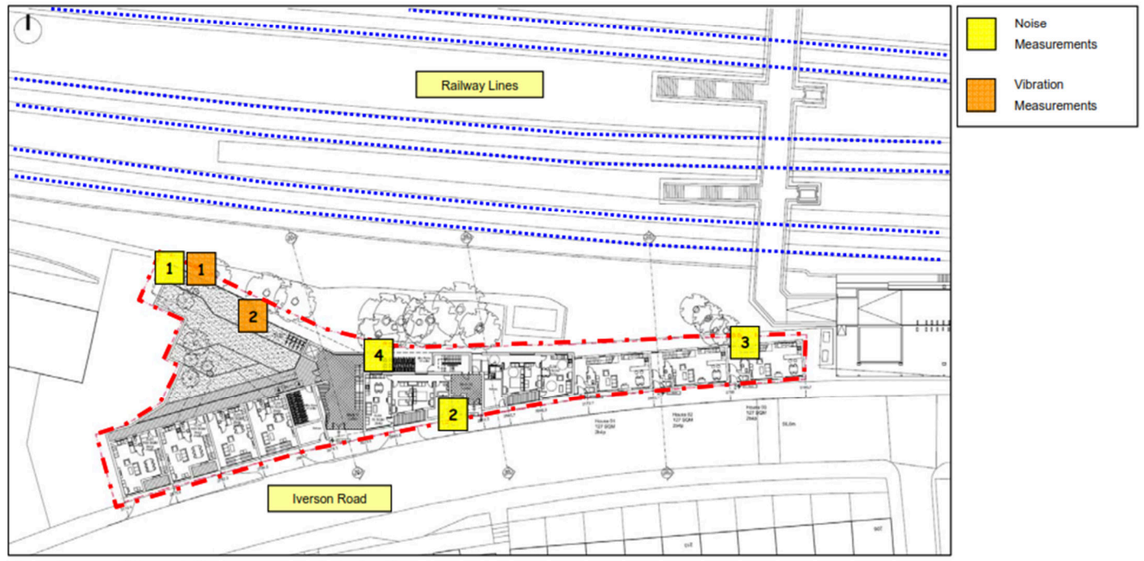

Figure 2: Noise and vibration survey monitoring locations

Unscreened

Name	M.	ID	Level Lr		Limit. Value		Land Use			Height	
			Day	Night	Day	Night	Type	Auto	Noise Type		
			(dBA)	(dBA)	(dBA)	(dBA)				(m)	
Ref. position P1 @1.5m		2021_P1_1.5m	62.2	61.5	0.0	0.0				1.50	r
Ref. position P4 @1.5m		2021_P4_1.5m	57.4	56.4	0.0	0.0				1.50	r
Ref. position P1 @5m		2021_P1_5m	62.2	61.4	0.0	0.0				5.00	r
Ref. position P4 @5m		2021_P4_5m	60.5	59.8	0.0	0.0				5.00	r

Screened

Name	M.	ID	Level Lr		Limit. Value		Land Use			Height	
			Day	Night	Day	Night	Type	Auto	Noise Type		
			(dBA)	(dBA)	(dBA)	(dBA)				(m)	
Ref. position P1 @1.5m		2021_P1_1.5m	52.6	51.6	0.0	0.0				1.50	r
Ref. position P4 @1.5m		2021_P4_1.5m	55.4	54.7	0.0	0.0				1.50	r
Ref. position P1 @5m		2021_P1_5m	62.2	61.4	0.0	0.0				5.00	r
Ref. position P4 @5m		2021_P4_5m	60.1	59.3	0.0	0.0				5.00	r

IVERSON ROAD, LONDON
ENVIRONMENTAL INTRUSIVE NOISE & VIBRATION STUDY
P1498-REP01-SJF

4.0 SUMMARY MEASURED NOISE DATA

Table 1 provides a basic summary of the average, free field noise levels measured at the various locations around the site, in L_{Aeq}, L_{A90} and L_{Amax} terms:

	Typical Measured Noise Level (Average L_{Aeq}, Range L_{Amax} and L_{A90})					
	Daytime			Night time		
Position	dB, L_{Aeq}	dB, L_{Amax}	dB L_{A90}	dB, L_{Aeq}	dB, L_{Amax}	dB L_{A90}
1	65	50 to 98	42 to 59	56	40 to 86	36 to 62
2	63	71 to 92	44 to 57	58	46 to 93	36 to 50
3	60	66 to 81	43 to 49	n/a	n/a	n/a
4	60	59 to 86	43 to 50	53	44 to 80	34 to 47

Table 1: Summary of typical, measured environmental noise levels, in broadband terms

All measurements to date have been on open sites exposed to both the railway and Iverson Road.
The Sol Acoustics measurements were made over less than 24 hours and should not have been an acceptable basis for railway noise design. These were evaluated by others during planning condition discharge and deemed reasonable.
Previous Aulos Acoustics measurements were made over six days and resulted in:
Daytime $L_{Aeq,16h}$ 63.7dB including all sources (free field; exposed site)
A predicted railway sound level of 62.2dB [63dB future] in the absence of other sources and screened from the road is a reasonable representation of the Position P1 data.
The modelled sound levels are within the range of variation expected between modelled data and measured data. The modelled data are expected to present less uncertainty due to the use of a standard model of movements, rather than including local daily variation.

29 July 2021
0-3563-1a

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ADDENDUM

Reports and documents under previous planning applications
References included in report above