ACOUSTIC REPORT

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Date:	7 January 2016
Subject:	Abbey Area Phase 1 – CMP Noise Assessment

Introduction

Following the demolition of the existing car park and retail building situated on the junction of Abbey Road and Belsize Road and adjacent to the railway, a new development is to be constructed comprising a total of 296No. residential units with six storeys of residential units to the south-western end of the building and a tower comprising thirteen storeys of residential units to the north-eastern end of the building. Phase 1 of the development is to be formed from a 14 storey tower block linked to 5No. 6 storey blocks comprising 75No. new build residential units, 66No. new build affordable units, 1No. A1 retail unit and 2No. B1 commercial spaces, with basement car parking for 52 cars.

There are existing residential properties in the vicinity of the site, the nearest residency being 181 Belsize Road approximately 5m from the south-west site boundary on Abbey Road and other residencies in the surrounding areas.

London Borough of Camden (LBC) have requested an assessment be carried out on anticipated construction noise to the surrounding areas. Due to the height of the 14 storey tower, a 3D model has specifically been requested to predict noise levels.

This document presents the results of the construction noise predictions in tabular form and in the form of plotted noise contours for each construction phase. Guidance on best practicable means (BPM) to ensure the noisy works undertaken are mitigated as far as possible and in accordance with Camden's Minimum Requirements (CMR) are also detailed.

This report deals solely with the construction phases based on worst-case operation assumptions. A Site Plan illustrating the context of the site and the adjacent residential properties is included as Site Plan 7146/SP1.

Outline Description of Work

As is our understanding, the development is to be formed from a reinforced concrete (RC) frame, with areas of external façade comprising Metsec framing with outer layers of brick or lightweight cladding.

We therefore understand that the main construction activities will include sheet piling (hydraulically jacked), foundation piling (CFA), use of excavators with attachments for ground works, distribution of materials, pile cropping and reinforcement cutting, concrete pumping with vibratory equipment, along with the use of tower cranes, lorries, and hand tools for erection and striking of scaffolds and formwork. There is no secant or contiguous perimeter piling proposed.

This assessment focuses on the predominantly noisy activities, i.e. excavation, piling, concrete pumping, reinforcement cutting, as well as hand tools during formwork assembly and processing of materials. Installation of cladding or internal fit out, for example, have therefore not been assessed.

Assessment Methodology and Criteria

BS 5228:2009 "Code of practice for noise and vibration control on construction and open sites" provides guidance on the prediction of noise and vibration levels from construction and demolition sites, along with details of how to control such emissions.

The contractor intends to undertake noise monitoring to ensure noise levels do not regularly exceed agreed trigger levels (defined as 3dB (A) above predicted levels in the CMR's) at the nearest residential properties during most work phases following guidance within BS5228:2009 and in accordance with Camden's Minimum Requirements.

Continuous monitoring equipment will be installed at positions agreed with LBC capable of real-time upload of data. Log-ins are available to access all data via web portal. Site representatives will receive trigger alerts as appropriate and this can be extended to include representatives of London Borough of Camden.

Machinery Information

The noisiest construction activities have been identified and we have discussed details of the proposed machinery likely to be used by the contractor. Where noise levels for the specific item has been provided this is detailed. Where noise levels are not provided, these have been approximated using the database of plant included in BS 5228:2009 – Part 1.

Also included is the estimation of the 'on-time' of each item of equipment, i.e. the percentage of the day during which the equipment will be in use during the phase of work. Please note – for the purpose of these calculations we have assumed that work will be carried out over the entire day (10 hours – 08:00-18:00) and therefore an on-time of 80% would correspond to 8 hours.

Table 7146/T1 – Assumed Plant Noise Levels

Activity	Plant Item	BS5228 ref.	Sound Pressure Level ($L_{Aeq,T}$) at 10m	Assumed on-time (%) 10-hour day
Sheet steel piling – hydraulic jacking	Sheet piling	C3/9	63	40
Foundation piling	CFA piling rig SF-65	Manufacturer	79	40
	Tracked excavator	C3/23	68	40
	Concrete pump	C3/25	78	40
	Concrete mixer truck	C3/20	80	40
Excavation	Wheeled excavator	C2/14	79	40
	Dumper	C2/30	79	40
	Breaker mounted on excavator	C2/9	90	40
	Handheld hydraulic breaker	C1/7	93	10
	Angle grinder	C4/93	80	10
Basement/ground floor	Angle grinder	C4/48	80	10

Activity	Plant Item	BS5228 ref.	Sound Pressure Level ($L_{Aeq,T}$) at 10m	Assumed on-time (%) 10-hour day
level construction	Concrete pump + cement mixer truck	C4/24	67	40
	Poker vibrators	C4/33	78	40
RC Frame (general)	Angle grinder	C4/48	80	10
	Concrete pump + cement mixer truck	C4/24	67	40
	Poker vibrators	C4/33	78	40
	Tower crane	C4/48	76	50
	Lifting platform	C4/57	70	50
	Handheld hammer (formwork assembly)	D2/15	84	20

We understand that a temporary gas powered generator will be located close to the site offices in the south-west corner of the site, until the temporary substation is installed to the north-west end of the site. Gas generators are typically quieter than diesel generator alternatives and generally "packaged"; therefore we consider noise generated by the generator unlikely to affect nearby residents due to considerate placement and additional screening as required.

We also understand that a generator will be used by the CFA piling rigs to pump concrete. This generator is to generally be positioned centrally on-site to maximize distance to surrounding residents. However, this generator will be required to move around site as works progress, acoustically screened as required.

Construction Noise Assessment

Noise levels have been predicted using the methodology set out in BS 5228 and using the CadnaA 3D acoustic modelling software. The software takes into account barriers, screening afforded by buildings, distance losses etc. as outlined in ISO9613.

The approach taken is to determine the activity L_{Aeq} noise level (at a standard distance) of the equipment and then calculate the noise level at the point of interest by applying corrections to account for:

- The number of plant items
- The periods of operation of processes and plant;
- Screening from existing buildings or hoarding (2.4m height assumed around entire site)
- The distances from sources to receiver; and
- Reflection from façades

The close proximity of 181 Belsize Road to the site means that there is minimal attenuation to noise levels provided by natural distance losses when works are undertaken at the extreme south-west site boundary.

Based on the proposed works and associated on-times the following table shows the cumulative resultant average $L_{Aeq,10hours}$ external noise levels due to construction works at 181 Belsize Road, 125 Belsize Road and Casterbridge. Predictions are also illustrated on Noise Maps 7146/NM1-9, at a calculation grid of 6m above ground to take account of worst affected windows to the works.
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Table 7146/T2 – Predicted Construction Noise Levels at Nearest Sensitive Receptors

Construction Activity	Predicted Cumulative External Noise Level ($L_{Aeq,10hours}$) 181 Belsize Road	Predicted Cumulative External Noise Level ($L_{Aeq,10hours}$) 125 Belsize Road	Predicted Cumulative External Noise Level ($L_{Aeq,10hours}$) Casterbridge south-west façade (worst-case height)
Sheet steel piling, close to the south-west boundary	64	64	57
Foundation piling, close to the south-west boundary	67	50	50
Foundation piling, centre of the site	61	56	54
Excavation, close to the south-west boundary	77	62	60
Excavation, centre of the site	65	66	64
Basement/ground floor level construction, close to south-west boundary	67	61	60
RC Framework, close to south-west boundary - 6th floor level	66	59	61
RC Framework, close to north-east boundary - 12th floor level	62	61	67

Discussion

Sheet Steel Piling

The process of sheet steel piling by hydraulic jacking is regarded as generating relatively low levels of noise. Based on our noise model, we predict noise levels of approximately 64dBA $L_{Aeq,10hours}$ at the worst-affected properties, these being 181 and 125 Belsize Road. Based on background noise measurements prior to site-works, this is comparable to the prevailing background noise level of approximately 66dBA $L_{Aeq,10hours}$ during site hours.

Foundation Piling

Foundation Piling, Close to South-west Boundary

The process of CFA piling is regarded as generating relatively low levels of noise in comparison with other piling methods. Based on our noise model, we predict noise levels of approximately 67dBA $L_{Aeq,10hours}$ at the worst-affected property, this being 181 Belsize Road. Based on background noise measurements prior to site-works, this is comparable to the prevailing background noise level of approximately 66dBA $L_{Aeq,10hours}$ during site hours.

We note that the intention is to install approximately 15 CFA piles per day. When piling continues around the site, noise levels predicted at 181 Belsize Road will be significantly lower due to increased distance losses.

Foundation Piling, Centre of the Site

The process of CFA piling is regarded as generating relatively low levels of noise in comparison with other piling methods. Based on our noise model, we predict noise levels of approximately 61dBA $L_{Aeq,10hours}$ at the worst-affected properties, these being 181 and 125 Belsize Road. Based on background noise measurements prior to site-works, this is below the prevailing background noise level of approximately 66dBA $L_{Aeq,10hours}$ during site hours.

Excavation

Excavation, Close to South-west Boundary

We predict that the excavation process will give rise to the highest average noise levels in the surrounding areas. Our predictions are based on the use of a breaker mounted on an excavator in use 40% of the time during a typical day. Following pile probing by the demolition contractor, we understand that this is likely to be an overestimate and worst-case assumption. Based on this, when works are being carried out close to the south-west boundary we predict noise levels at the façade of 181 Belsize Road to be approximately 77dBA $L_{Aeq,10hours}$. Construction noise is likely to be audible within 181 Belsize Road during these works and the nearby residents should be liaised with closely.

Excavation, Centre of Site

We predict that the excavation process will give rise to the highest average noise levels in the surrounding areas. Our predictions are based on the use of a breaker mounted on an excavator in use 40% of the time during a typical day. Following pile probing by the demolition contractor, we understand that this is likely to be an overestimate and worst-case assumption. Based on this, when works are being carried out close to the centre of the site we predict noise levels at the façade of 181 Belsize Road to be approximately 65dBA $L_{Aeq,10hours}$ which is comparable to prevailing background noise level.

Frameworks

Basement/Ground Floor Level Construction, Close to South-west Boundary

Based on our noise model, we predict noise levels of approximately 67dBA $L_{Aeq,10hours}$ at the worst-affected property, this being 181 Belsize Road. Based on background noise measurements prior to site-works, this is comparable to the prevailing background noise level of approximately 66dBA $L_{Aeq,10hours}$ during site hours. We understand that the basement and ground slabs will take approximately 10 weeks in total to complete.

6th Floor Level Construction, Close to South-west Boundary

Based on our noise model, we predict noise levels of approximately 66dBA $L_{Aeq,10hours}$ at the worst-affected property, this being 181 Belsize Road. Based on background noise measurements prior to site-works, this is comparable to the prevailing background noise level of approximately 66dBA $L_{Aeq,10hours}$ during site hours. We understand that one floor slab will be completed approximately every three weeks.

12th Floor Level Construction, Close to North-east Boundary

Based on our noise model, we predict noise levels of approximately 67dBA $L_{Aeq,10hours}$ at the worst-affected property, this being Casterbridge on the junction of Abbey Road and Belsize Road. Based on background noise measurements prior to site-works, this is comparable to the prevailing background noise level of approximately 66dBA $L_{Aeq,10hours}$ during site hours.

Noise Trigger Levels

In accordance with Camden's Minimum Requirements, where the measured noise levels are more than 3dB(A) above the predicted noise levels or in the event of a complaint of noise an investigation shall be carried out to ascertain the cause of the exceedance or the complaint and to check that Best Practicable Means are being used to control the noise in accordance with the steps set out in the application for 'prior consent'. Noise levels shall be reduced further if it is reasonably practicable to do so.

As can be seen from Table 7146/T2 above, the predicted construction noise levels from worst-case works being undertaken close to the extreme site boundary with 181 Belsize Road are 77dBA $L_{Aeq,10hour}$ due to excavation works close to the site boundary.

It should be noted that these and the predicted levels at other properties are likely to be worst case noise levels occurring for a relatively short time period, as calculated at the minimum distance from the relevant boundary, and works occurring at greater distance will generally result in lower noise levels, i.e. when excavation occurs at the centre of the site, the predicted noise levels at the relevant property are significantly lower.

Therefore, in accordance with the above and Camden's Minimum Requirements, and the further external noise levels stated within Table 7146/T3, the following target trigger noise levels are proposed, based on the typical predicted noise levels:

Table 7146/T3 – Trigger levels

Position	External Noise Level Trigger ($L_{Aeq,T}$ dB)	
	$L_{Aeq,1h}$	$L_{Aeq,10h}$
Sensitive receptor	75	70

The hourly trigger will be used as an indicative trigger to ensure that the overall 10-hour criterion is achieved. Any exceedances will immediately be investigated by the contractor, with liaison with ourselves,

and assuming BPM is being undertaken, working practices will be investigated. If works are being undertaken within BPM but exceedances appear to be unavoidable, further investigations will be undertaken into working methods and to whether the trigger and target noise levels need reassessment. Some short term exceedances may be unavoidable during works close to the boundary as previously discussed. However, complaints and exceedances will trigger the investigation procedure regardless. Measurement data will be available as required.

Construction Vibration Prediction

There are two types of vibration impact that need consideration: the effects on people or equipment within buildings and the effect on buildings (or other structures) themselves.

The level at which vibration is perceptible / annoying to occupants is much lower than that required to result in cosmetic damage. Typically vibration limits of PPV 2mm/s are considered appropriate for assessing occupant comfort whereas PPV 15mm/s is typically adopted as the limit for cosmetic damage to buildings.

However, the vibration monitoring equipment is proposed to be set to have an amber alert of 1mm/s at the residential receptors in accordance with CMR with a red alert of 5mm/s PPV.

As a result of numerous factors including the geological and geographical differences between construction sites there is no reliable method for predicting vibration levels due to construction or demolition works. Although it is generally accepted that piling may cause some degree of ground vibration, modern rotary and "pressed in" methods are proposed which produce far lower levels of vibration than driven piling, for example. As such these methods are considered to be current Best Practicable Means.

It is possible that that vibration levels due to piling work will be perceptible at the receptors located within close proximity to the site, however the levels of vibration are expected to be well below those likely to lead to building damage. In terms of mitigating vibration levels, Best Practicable Means will be adopted. If necessary, greater confidence in the levels of vibration resulting from the worst case construction works could be achieved by undertaking sample vibration monitoring at representative locations so as to ensure the appropriate criteria are not being exceeded.

From our experience we are aware of the potential for perceptible levels of vibration within nearby residences to be associated with the movement of loaded skips. We would therefore advise that following delivery, all skips are left static until they are ready for collection.

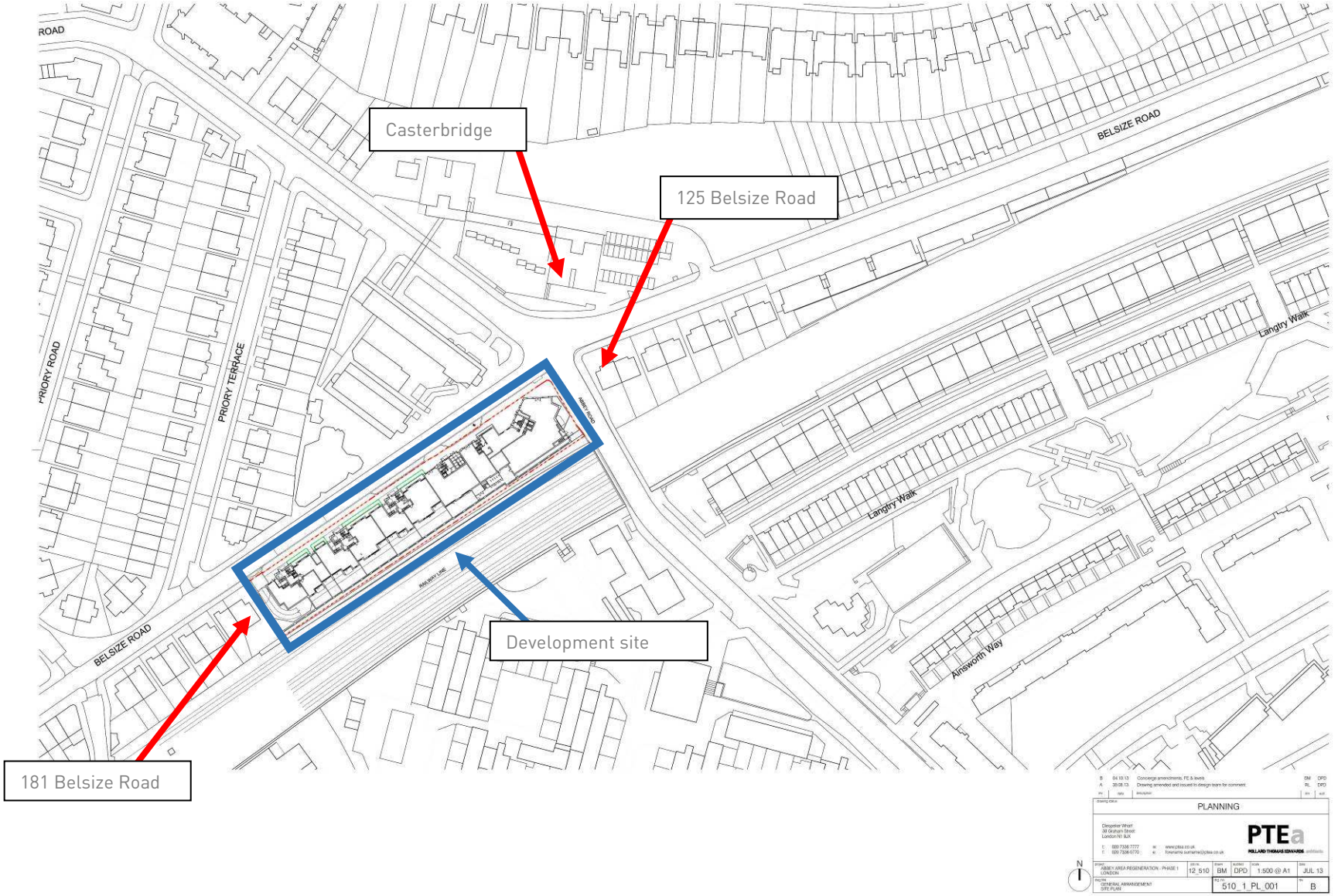
Mitigation

The contractor will adopt the following measures to mitigate noise and vibration, including:

- Careful selection of site preparation and construction methods and plant used to minimise noise at source as far as reasonably practical;
- Use of electric and electro-hydraulic plant and equipment where practical;
- Switching off engines when not in use;
- Regular maintenance and servicing of plant and equipment;
- The use of acoustic barriers where appropriate;
- Use of non-percussive tools and equipment where practical;
- Off-site steel and services prefabrication to limit the welding and cutting of materials on-site;

- Hydraulic construction to be used in preference to percussive techniques where practical;
- All plant and equipment to be used for the works will be properly maintained, silenced where appropriate and operated to prevent excessive noise and switched off when not in use and where practicable;
- Plant will be certified to meet relevant current legislation and BS5228 standards;
- All trade contractors to be made familiar with current legislation and the guidance in BS5228
- Noise complaints will be reported to the contractor and immediately investigated.

In addition to the above general measures, further mitigation measures can be applied as considered necessary as the project proceeds and as communicated through regular liaison with adjacent neighbours.



Abbey Area Phase 1, London
Location Plan

Site Plan 7146/SP1
7 January 2016

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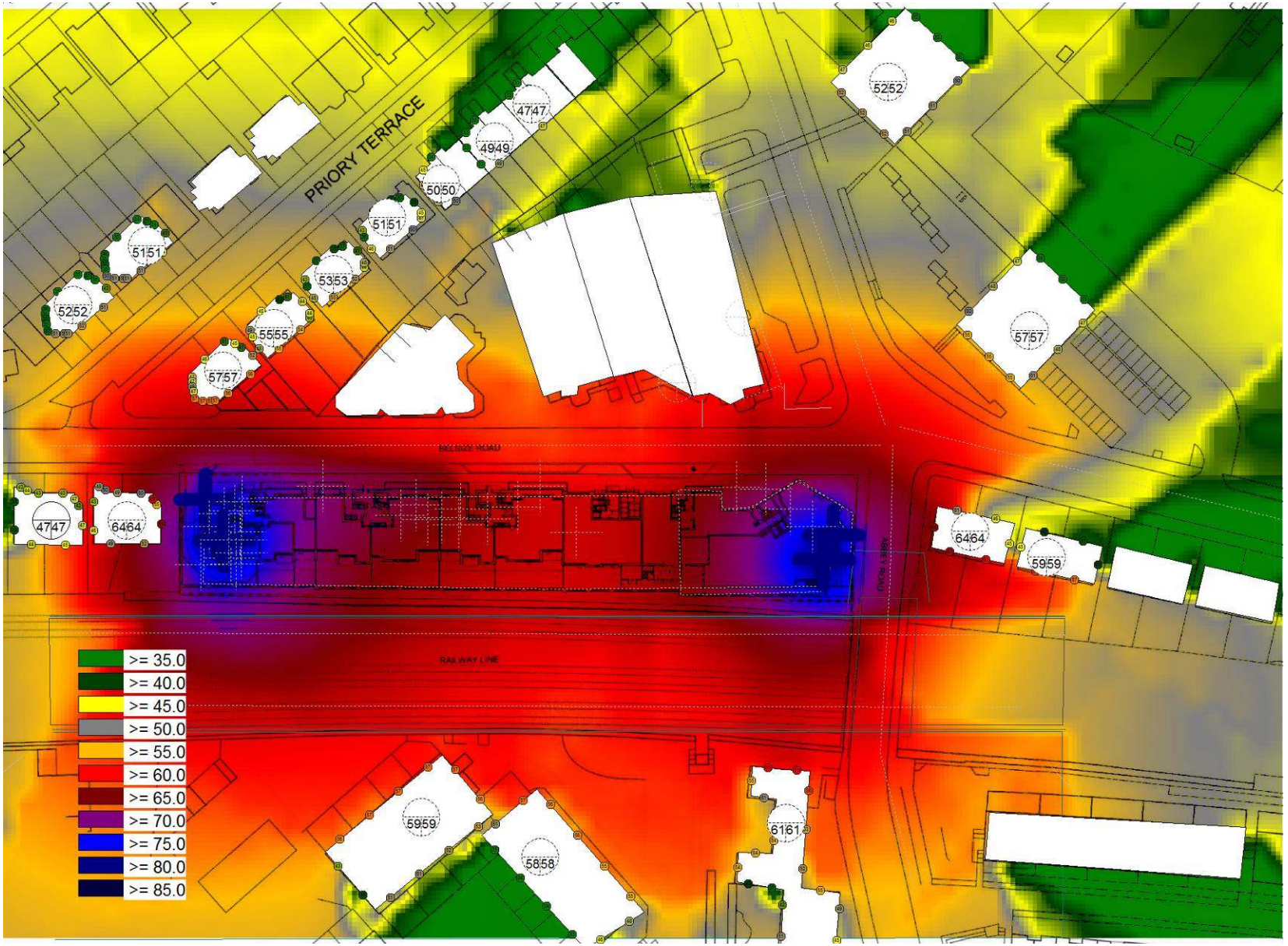

Abbey Area Phase 1, London
Noise Map
Sheet Sheet Piling, Close to South-west and North-east Corners
Assessment Grid at 6m Above Ground

Noise Map 7146/NM1
7 January 2016

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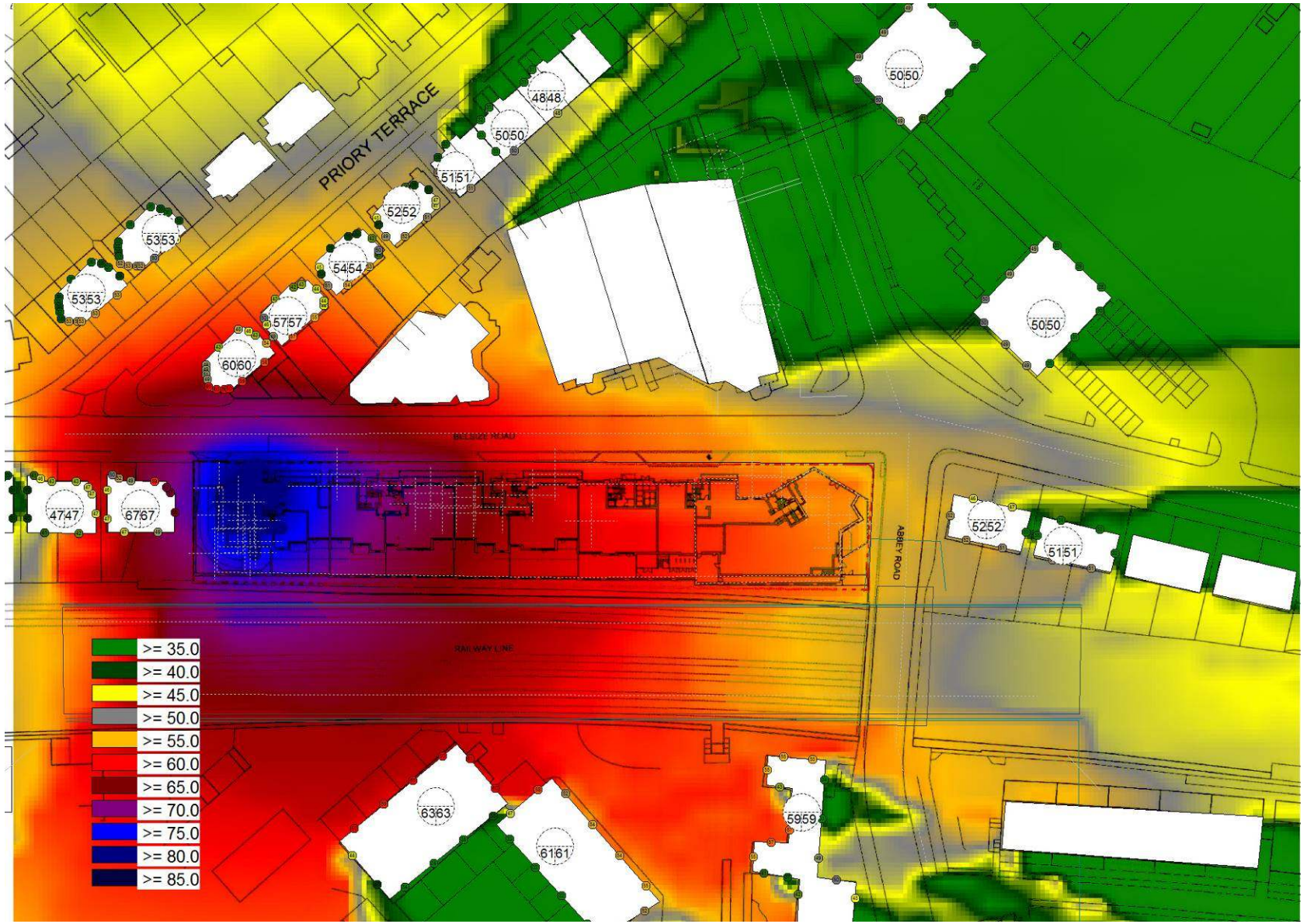

Abbey Area Phase 1, London
Noise Map
Foundation Piling, Close to South-west Corner
Assessment Grid at 6m Above Ground

Noise Map 7146/NM2
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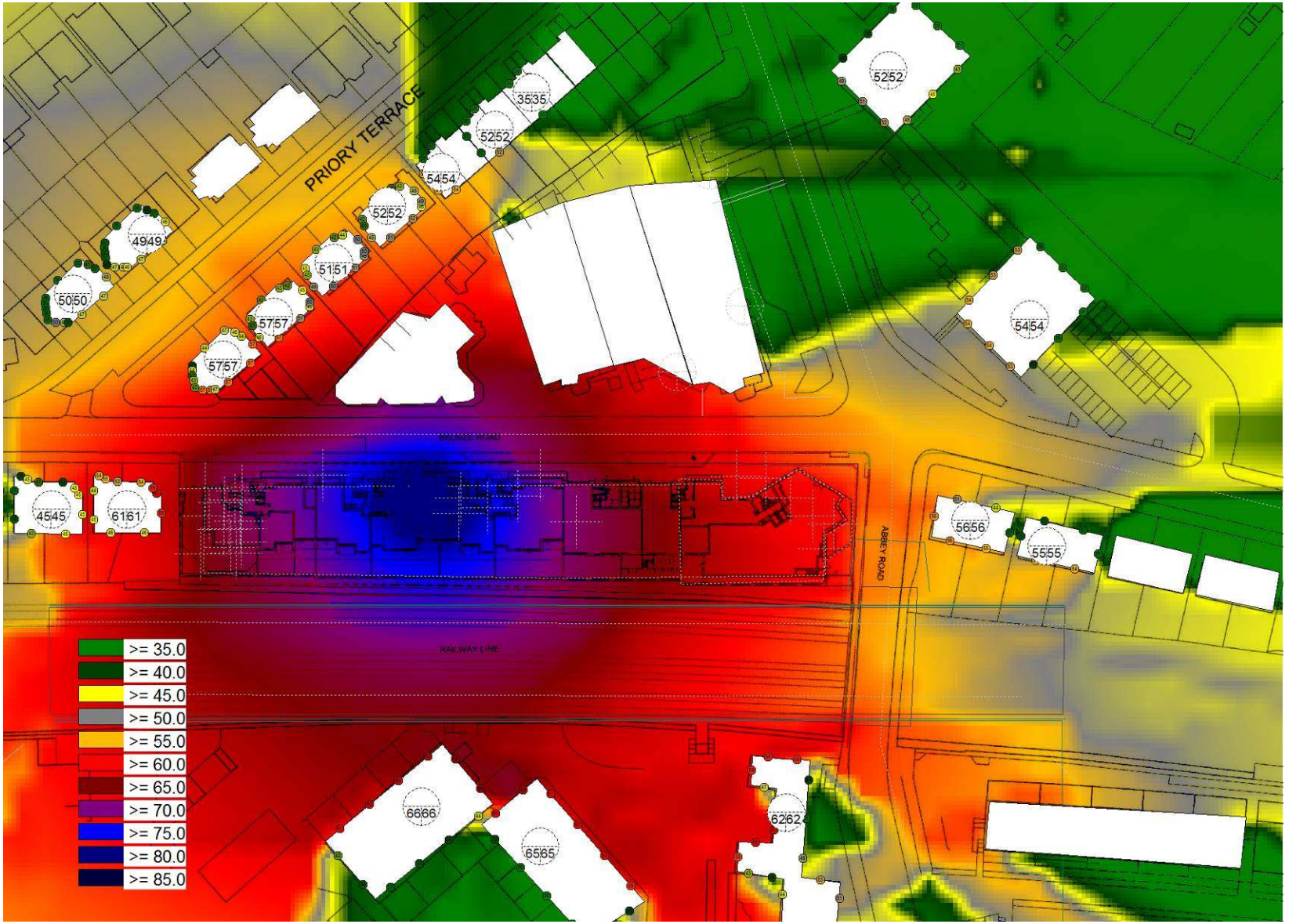

Abbey Area Phase 1, London
Noise Map
Foundation Piling, Centre of the Site
Assessment Grid at 6m Above Ground

Noise Map 7146/NM3
7 January 2016

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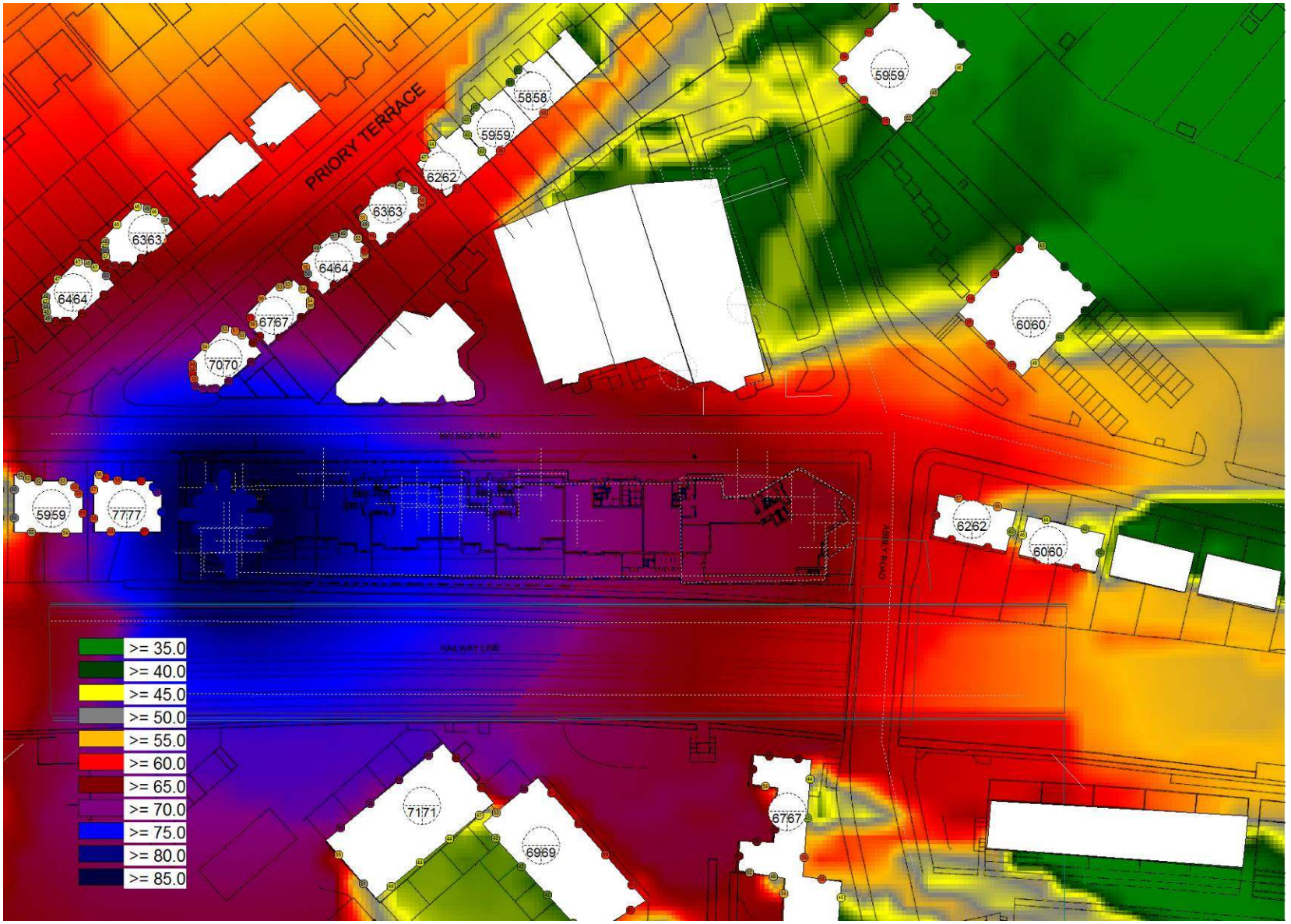

Abbey Area Phase 1, London
Noise Map
Excavation, Close to the South-west Boundary
Assessment Grid at 6m Above Ground

Noise Map 7146/NM4
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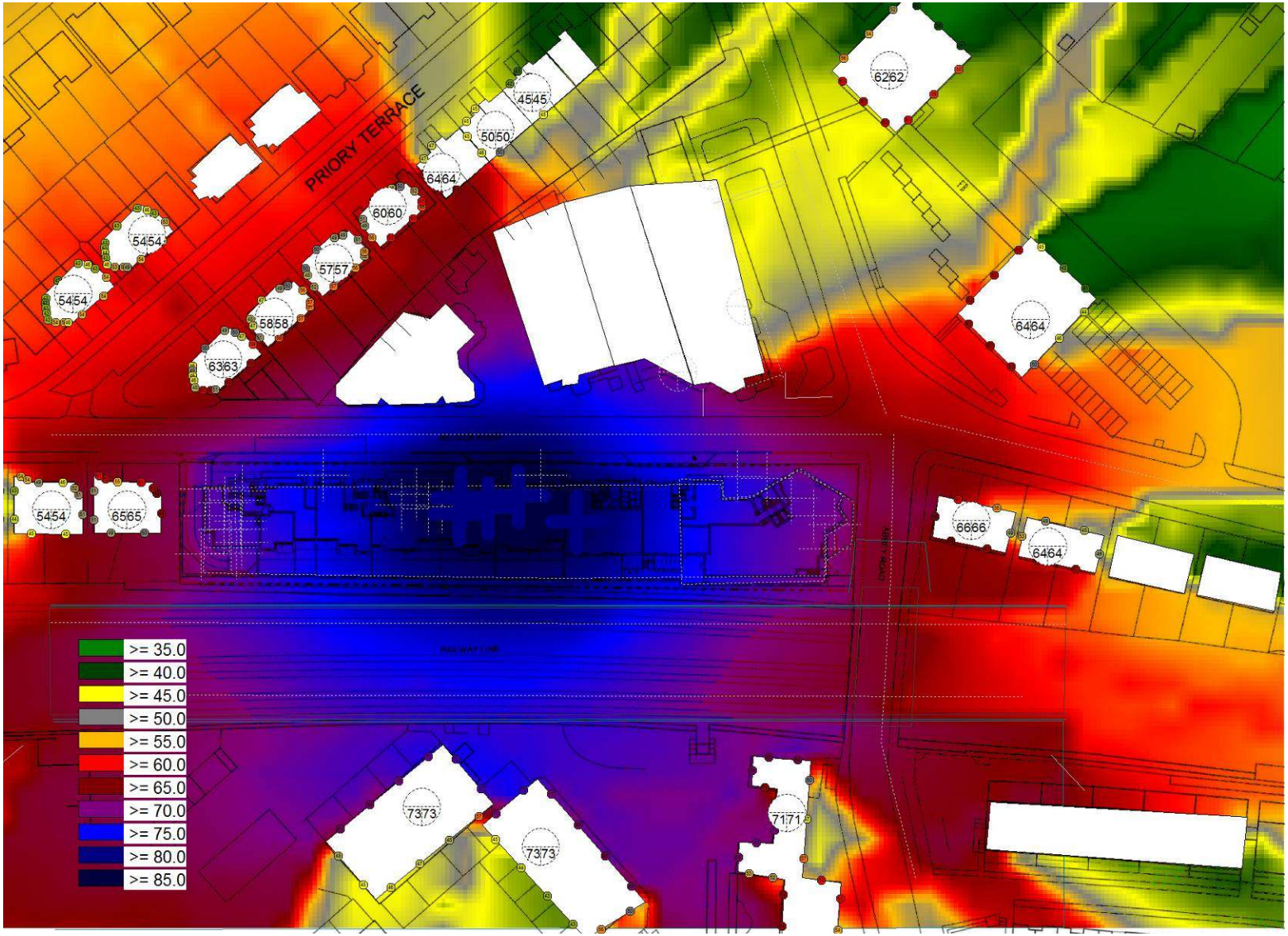

Abbey Area Phase 1, London
Noise Map
Excavation, Centre of the Site
Assessment Grid at 6m Above Ground

Noise Map 7146/NM5
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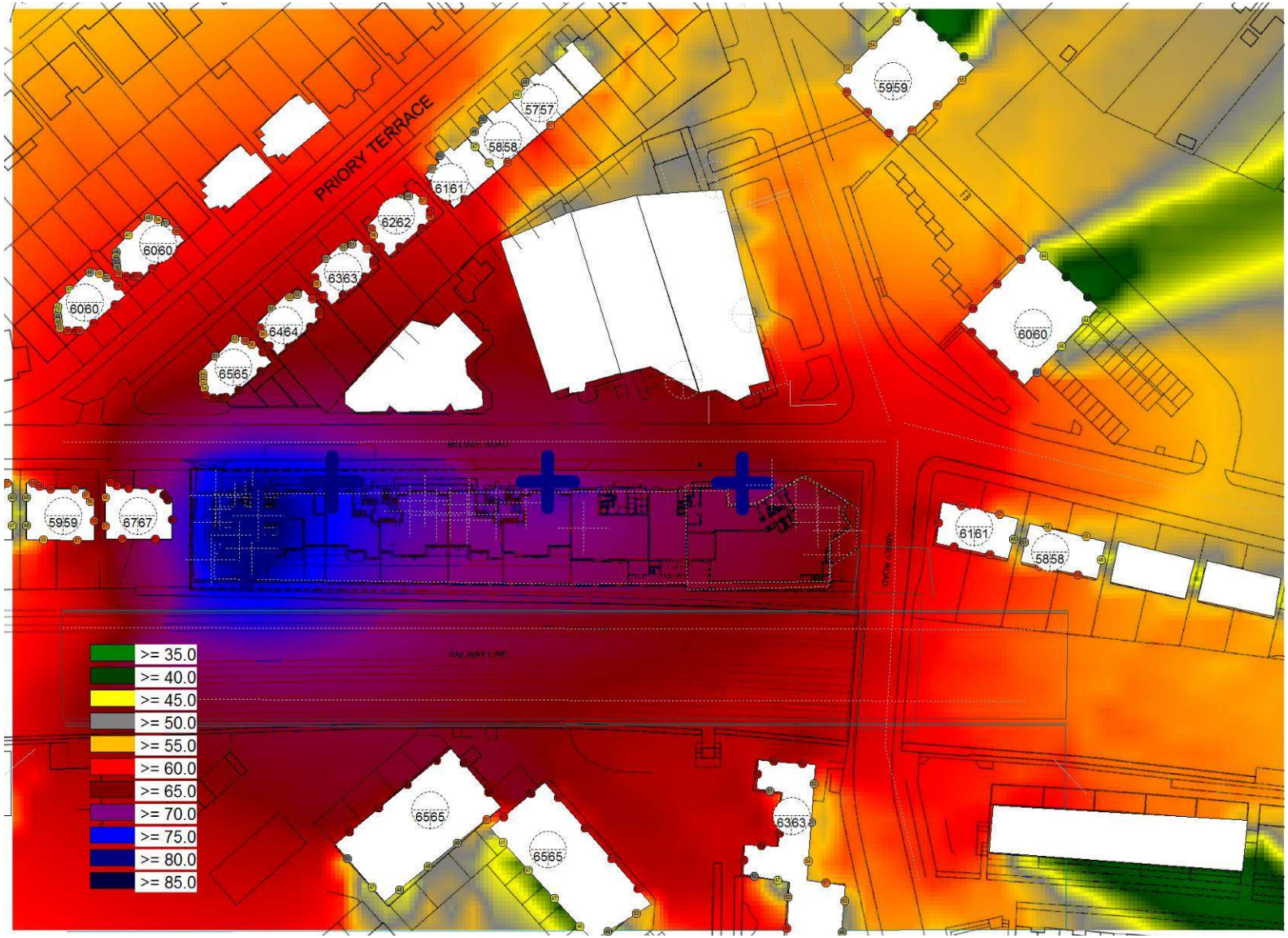

Abbey Area Phase 1, London
Noise Map
Basement/Ground Floor Level Construction, Close to South-west Corner of Site
Assessment Grid at 6m Above Ground

Noise Map 7146/NM6
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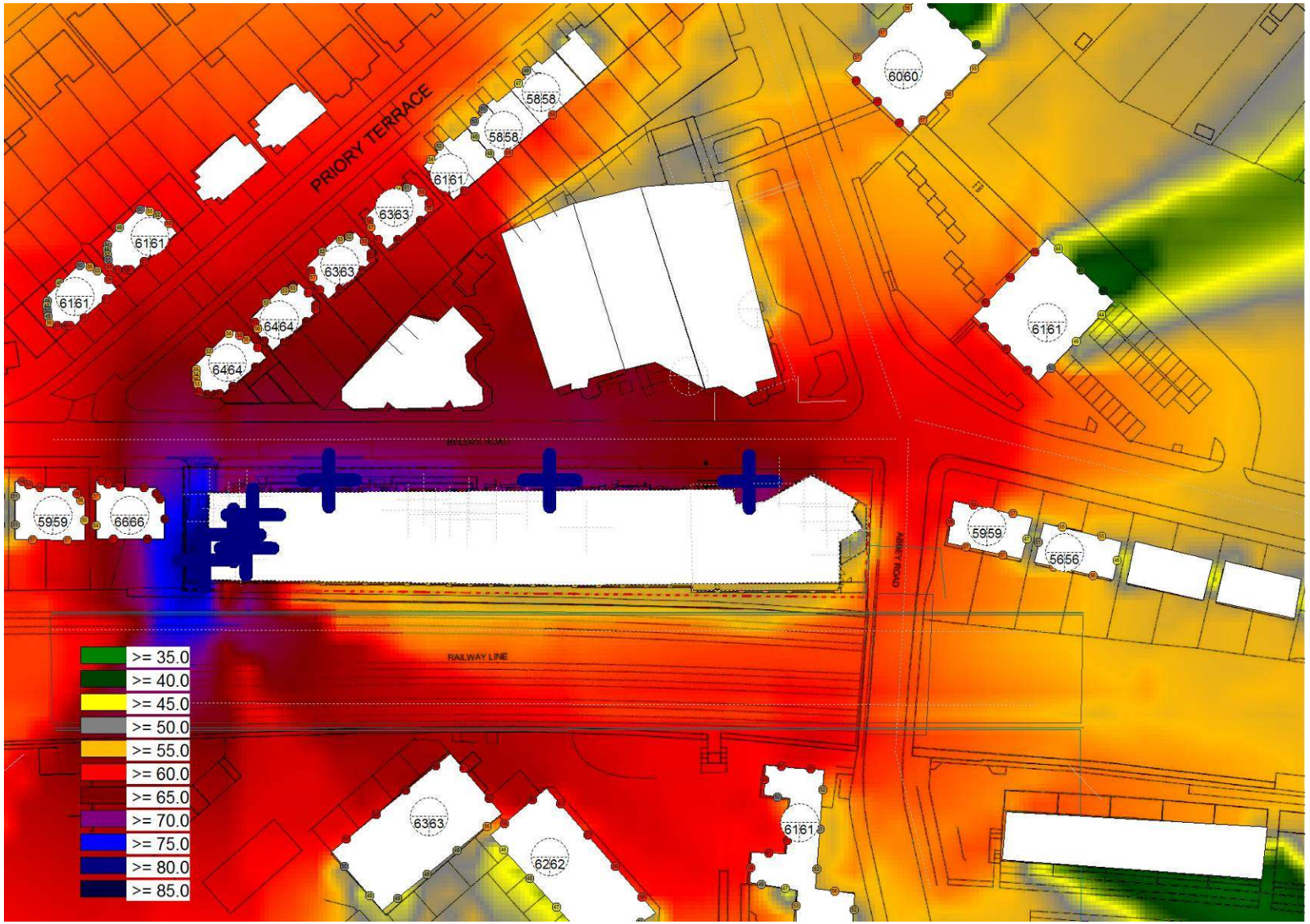

Abbey Area Phase 1, London
Noise Map
RC Framework 6th Floor, Close to South-west Corner of Site
Assessment Grid at 6m Above Ground

Noise Map 7146/NM7
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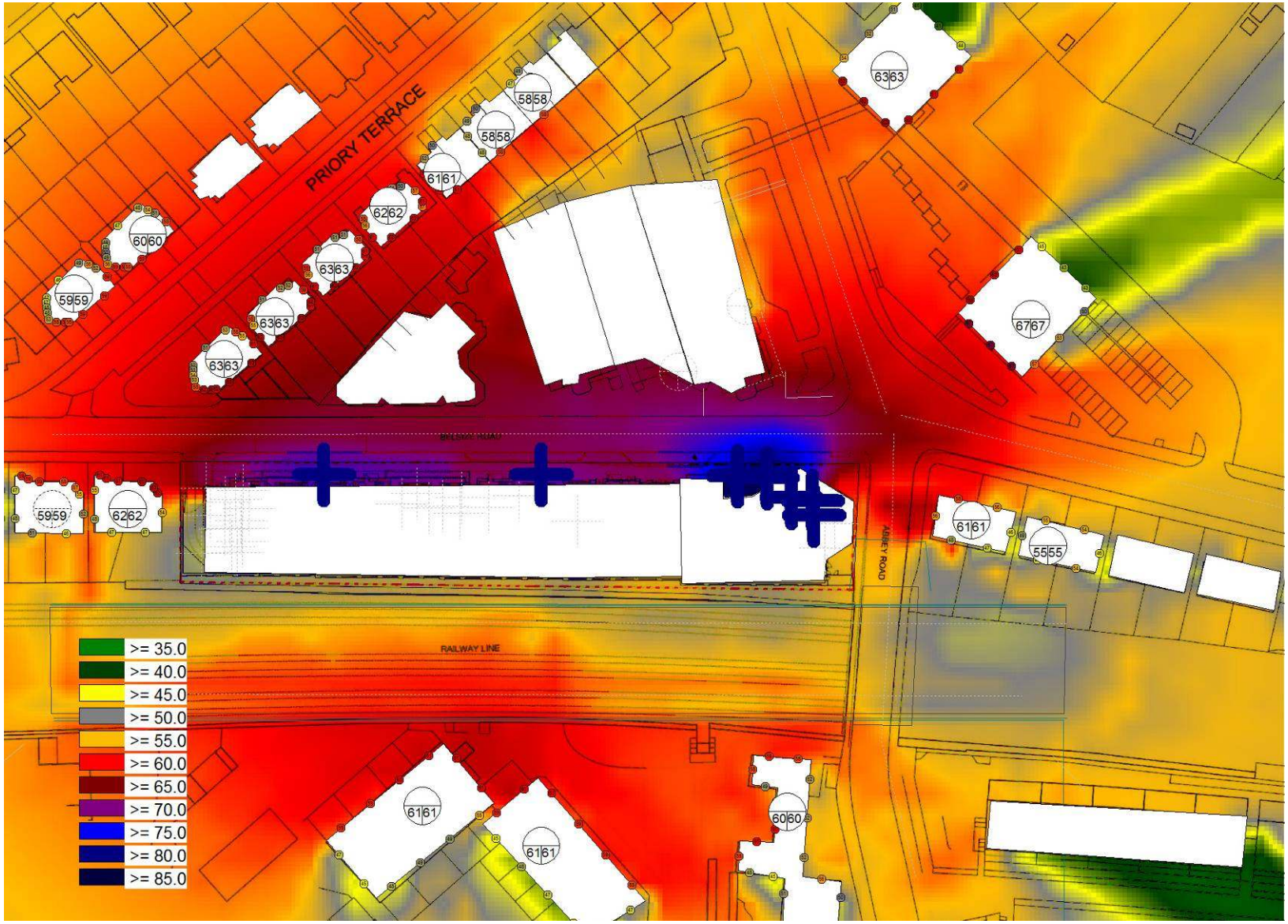

Abbey Area Phase 1, London
Noise Map
RC Framework 12th Floor, Close to North-east Corner of Site
Assessment Grid at 6m Above Ground

Noise Map 7146/NM8
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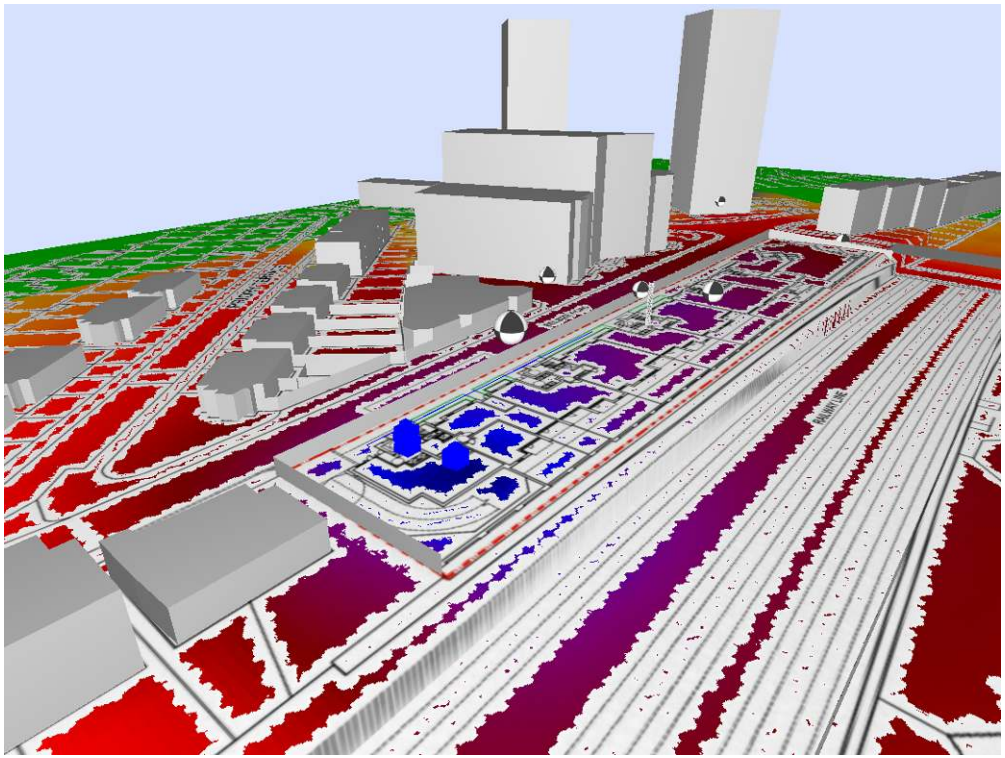
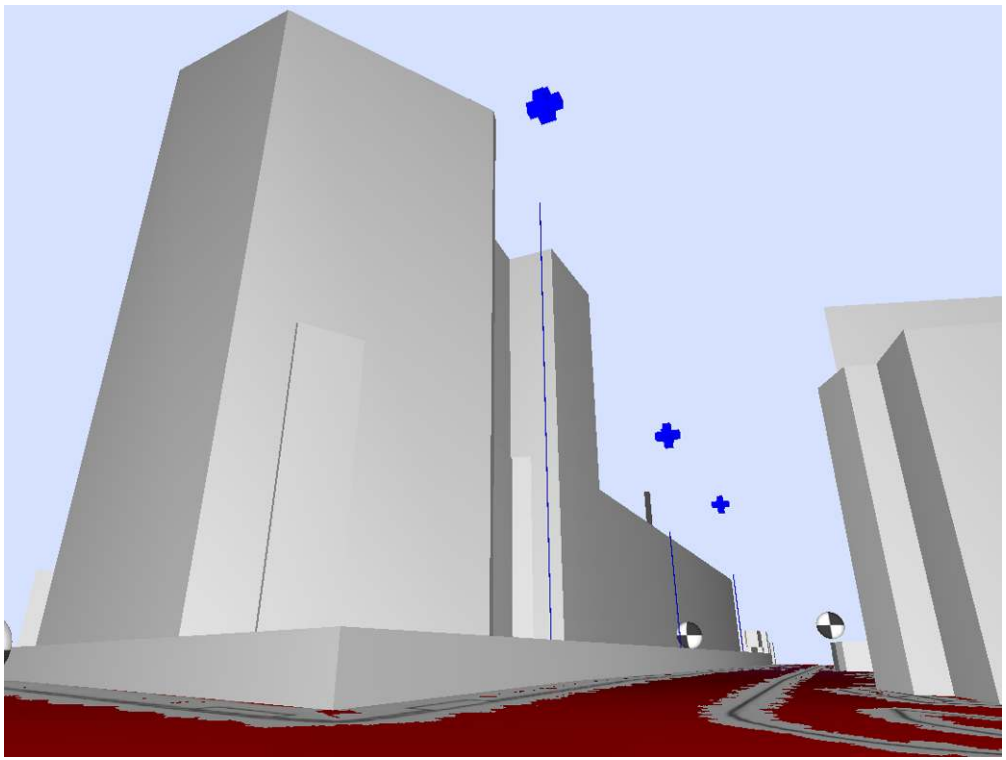


3D view of excavation close to north-west corner.
Viewed from south-west.



3D view of frameworks at 12th floor level
Viewed from north-east

Abbey Area Phase 1, London
Noise Map
3D View of Noise Model

Noise Map 7146/NM9
7 January 2016

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