



Brunswick PFI
Housing Scheme
Discharge of PC18
(Noise)

October 2014

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Prepared for:
Galliford Try Construction

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1. INTRODUCTION

1.1 Overview

URS Infrastructure & Environment UK Limited (URS) has been commissioned by Galliford Try Construction Ltd to undertake a noise assessment for the Brunswick PFI Housing Scheme. The redevelopment of the Brunswick Neighbourhood forms part of the Brunswick PFI regeneration project and has been granted planning permission by Manchester City Council (MCC) (Planning Application No. 101664/FO/2013/N2). As part of the planning conditions, Planning Condition 18 (PC18) requires that a suitable noise insulation scheme is submitted and approved prior to implementation. PC18 has been reproduced below:

Planning Condition 18

'Before any phase of the development hereby approved commences a scheme for acoustically insulating the residential accommodation within that phase against road traffic noise and music noise from the Apollo Theatre shall be submitted to and approved by the City Council as local planning authority. The approved noise insulation scheme shall be completed within each unit of accommodation before it is first occupied.'

1.2 Site Location & Setting

The Brunswick site (Ordnance Survey Grid Reference 385068, 396991) is part of a large housing estate located immediately south of central Manchester and comprises predominantly residential housing and social buildings with associated commercial developments and some small retail stores. A site location plan is appended to this report along with a plot type layout plan.

The site is approximately rectangular in shape and c.32 Ha in size. Site levels vary little over the site, ranging from circa. 35m AOD in the north of the site to c. 40m AOD in the south of the site. As this is the case, it has not been considered necessary to incorporate any topography into the noise model. However, where crucial features, such as the A57(M) are significantly elevated, this has been accounted for within the model.

1.3 Purpose

The purpose of this assessment is to determine the level of noise propagation across the site in order to provide advice on any necessary noise mitigation measures to the building envelope, such that suitable internal ambient noise levels are met within dwellings.

This report includes:

- An outline of the appropriate internal ambient noise level criteria
- Details of the computational noise modelling undertaken
- Details of the entertainment noise calculations undertaken
- Outline of required noise mitigation measures to achieve acceptable internal ambient noise levels within living rooms and bedrooms
- An assessment of noise levels in gardens and to terraces

2. NOISE CRITERIA

2.1 Local Authority Requirements (Ambient Noise Levels)

During the EIA process, Manchester City Council advised that the following internal ambient noise levels should not be exceeded for new housing within the city:

- | | |
|---|------------------------|
| • Bedrooms (night-time 23:00 - 07:00): | 30 dB L_{Aeq} |
| Individual noise events should not normally exceed: | 45 dB $L_{Amax(fast)}$ |
| • Living rooms (daytime 07:00 - 23:00): | 35-40 dB L_{Aeq} |
| • Gardens and terraces (daytime 07:00 - 23:00): | 55 dB L_{Aeq} |

The above criteria have therefore been adopted within this assessment and the acoustic specifications for the building envelope are reflective of achieving these criteria.

The above average internal ambient noise level limits have also been adopted to assess entertainment noise, as later agreed with MCC Environmental Health. In the case of living rooms, the lower noise level limit within the range has been adopted for the entertainment noise assessment i.e. 35 dB(A).

3. ROAD TRAFFIC NOISE MODELLING

3.1 Noise Model

Computational noise modelling has been undertaken for the site using SoundPlan software. The noise model is based upon the dominant noise source across the site i.e. road traffic noise. The modelled noise levels are based on 2022 flows with development. This is considered to be a more robust approach than simply relying on measured noise levels.

The A57(M) Mancunian Way data is based on 2012 24 hour AADT flows from the Department of Transport Traffic Counts website. The adopted data relates to count point ID 75243, west of Upper Brook Street. In adopting the data for this count point, it represents a reasonable worst-case scenario, as the 2012 24 hour AADT flows associated with count point ID 6069 between Upper Brook Street and Downing Street are lower. The 2012 24 hour AADTs were converted to 18 hour AAWTs for input into the noise model and were growthed up to 2022 flows.

The adopted traffic data is given in Table 3.1 below.

TABLE 3.1: TWO WAY 2022 AAWTs / % HGVs / TRAFFIC SPEED			
Link	18hr AAWT	% HGVs	Speed (kmph)
A6 Downing Street (Upper)	36229	11.9	48
A6 Downing Street (Lower)	31398	13.2	48
Grosvenor Street	7747	2.8	48
Ardwick Green N	1151	2.1	48
Ardwick Green S (Upper)	30319	13.1	48
Ardwick Green S (Lower)	29366	13.3	48
Hamsell Road	607	1.5	48
Higher Ardwick	10750	3.1	48
Hyde Road	21234	12.2	48
Stockport Road	14830	11.3	48
Brunswick Street	14863	3.6	48
Upper Brook Street	36779	4.2	48
Brunswick Street	6140	3.7	48
Upper Brook Street	37778	3.6	48
Inchley Road	3959	1.1	48
Booth Street E	14339	1.0	48
Upper Brook Street	28621	4.0	48
Grosvenor Street	12231	5.0	48
Brook Street	25567	3.2	48
A57(M) Mancunian Way	86242	3.7	81

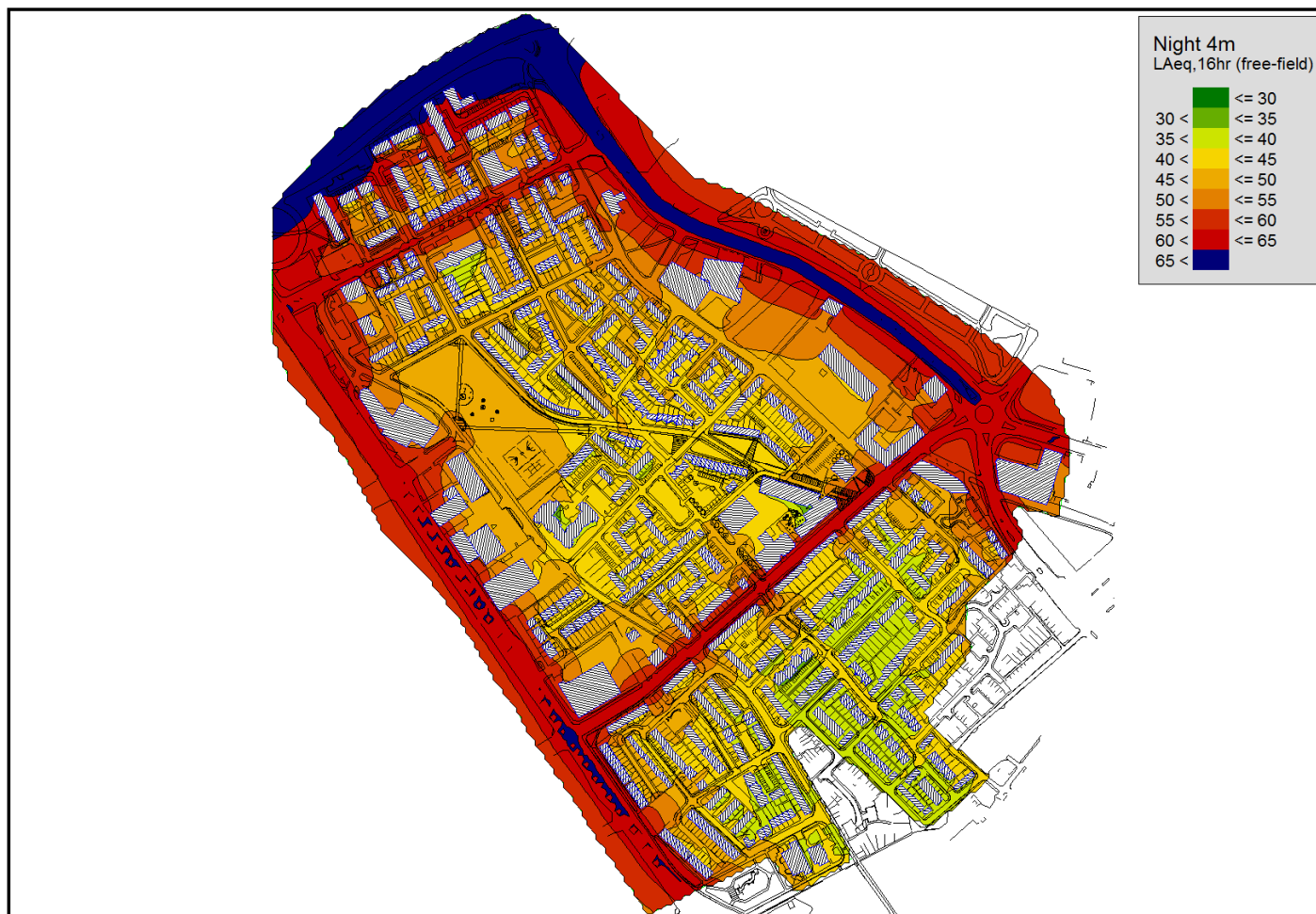
Two scenarios have been modelled for the site: 1) Daytime (07:00-23:00) at local ground level +1.5m and 2) Night-time at local ground level +4.0m. This then provides the necessary information to determine the required mitigation measures to living rooms for during daytime hours, and to Bedrooms for during night-time hours. In order to represent a reasonable worst case scenario, these heights are also used to determine the mitigation measures to the Polygon building.

The outputs of the noise model are given in Figure 3.1 and Figure 3.2 for the daytime and night-time scenarios respectively.

Figure 3.1: Modelled Daytime Road Traffic Noise Levels



Figure 3.2: Modelled Night-time Road Traffic Noise Levels



4. ENTERTAINMENT NOISE

4.1 O2 Apollo

The Polygon building, along with several other new-build plots will be relatively exposed to noise associated with the O2 Apollo venue (formerly the Apollo Theatre). It is therefore necessary to consider entertainment noise at these noise sensitive receptors. It should be noted that the proposed Polygon building is not on the 'Polygon' parcel of land itself, but falls directly behind this.

URS undertook noise monitoring between 18:30 - 23:30 hours on 25th September 2014. Two noise monitoring locations used; 1) Internally, within the front Bedroom of No. 2 Polygon Street and 2) Externally, fixed to a lighting column at approximately 4m at the end of a cul-de-sac off Beamish Close. A noise monitoring location plan is appended to this report.

Measurements were undertaken during a Lauren Hill gig. It is considered that the gig produced a reasonable level of low frequency noise and that it could be considered as being reasonably representative of typical low frequency noise associated with the O2 venue.

Events that were noted to have occurred during the noise monitoring period included:

- People arriving and queuing outside the venue (18:45 hours)
- Doors open (19:00 hours)
- Noise from people outside venue dominant (20:05)
- Some contribution from music noise (20:30)
- People start leaving the Apollo (22:35)
- Significant number of people leaving the Apollo (22:43)

The external noise level measurements at Monitoring Location 2 were used to calculate the required noise mitigation measures. This monitoring location is relatively equidistant to the distance between the O2 Apollo and the nearest residential property; therefore it can be considered to be representative. The internal noise level measurements were undertaken for information only and are not considered within this report. The reasonable worst-case 5 minute measured noise level is given in octave bands in Table 4.1 below.

TABLE 4.1: SUMMARY OF MEASURED NOISE LEVELS									
	L _{eq} (dB) 1/1 OCTAVE BAND LEVELS								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Free-field external noise Level	68	65	61	60	61	57	46	38	64

4.2 Entertainment Noise Ingress Calculations

In order to assess entertainment noise from the O2 Apollo breaking in to near-by dwellings, noise break-in calculations in octave bands have been undertaken. The properties to which the entertainment noise considerations apply are the multi-residential building and the 18No. dwellings within its vicinity. The specification however does not apply to the rear elevations of the 3No. pairs of semis and adjacent row of 7No. terraces; for this situation the specification in Section 5 of this report should be referred to.

In order to control entertainment noise break-in, it will be necessary to adopt a whole building mechanical ventilation system to the considered properties. In order to represent a reasonable worst-case scenario, all calculations are based on a total façade area of 12m², with 6m² of this comprising glazing and the remaining 6m² comprising a cavity masonry wall.

4.3 Living Rooms

The below table sets out the noise break-in calculations to living rooms affected by entertainment noise.

TABLE 4.2: ENTERTAINMENT NOISE INGRESS TO LIVING ROOMS

	L _{eq} (dB) 1/1 OCTAVE BAND LEVELS								
	63	125	250	500	1000	2000	4000	8000	dB(A)
External noise level	68	65	61	60	61	57	46	38	64
Glazing: 10 / 16 / 6	18	27	26	33	39	39	47	49	-
External Wall: Masonry Cavity	27	33	40	44	53	61	68	69	-
Predicted Internal Noise Level	54	41	37	29	23	19	0	0	33

It can be seen from the above that provided a minimum glazing specification of 10 / 16 / 6 installed to living rooms of properties within the vicinity of the O2 Apollo along with the adoption of a whole building mechanical ventilation system, then an internal noise level of 33 dB(A) will be achieved. This is 2 dB lower than the criterion of no greater than 35 dB(A).

4.4 Bedrooms

The below table sets out the noise break-in calculations to bedrooms affected by entertainment noise.

TABLE 4.3: ENTERTAINMENT NOISE INGRESS TO BEDROOMS

	L _{eq} (dB) 1/1 OCTAVE BAND LEVELS								
	63	125	250	500	1000	2000	4000	8000	dB(A)
External noise level	68	65	61	60	61	57	46	38	64
Glazing: 10.8 AcLam / 16 / 8.8 AcLam	18	27	36	43	52	55	59	61	-
External Wall: Masonry Cavity	27	33	40	44	53	61	68	69	-
Predicted Internal Noise Level	54	41	28	21	12	4	0	0	30

It can be seen from the above that provided a minimum glazing specification of 10.8 AcLam / 16 / 8.8 AcLam is installed to bedrooms of properties within the vicinity of the O2 Apollo, then an internal noise level of 30 dB(A) will be achieved. This is equal to the criterion of no greater than 30 dB(A). The properties to which this applies are the multi-residential building and the 18No. dwellings within its vicinity. The specification however does not apply to the rear elevations of the 3No. pairs of semis and adjacent row of 7No. terraces; for this situation the specification in Section 5 of this report should be referred to.

5. NOISE MITIGATION MEASURES GENERALLY

5.1 Introduction

Provided that the noise mitigation measures as set out below are implemented then the MCC requirements for internal ambient noise levels will be met. For properties within the vicinity of the O2 venue, the mitigation measures will be determined by the entertainment noise assessment as set out in Section 4 of this report.

The required noise mitigation measures shall be determined by referring to the noise model colour contour plots. It is recommended that this exercise is carried out for each elevation on a plot-by-plot basis. There may be some minor value engineering gains from approaching the exercise on an individual room-by-room basis, although this would likely lead to confusion during specification and implementation on-site.

Example acoustically suitable outline specifications for glazing and ventilation are given in Table 5.1 and Table 5.2 overleaf. A standard masonry cavity wall e.g. facing brickwork, 100mm cavity and 100mm blockwork inner-leaf with standard structural wall ties would be acoustically suitable for all properties.

In order to determine the required acoustic glazing and ventilation specification to living rooms, Figure 3.1 should be referred to in order to determine the daytime external noise level band at the specific dwelling location. Based on the predicted noise level band from the coloured contour plot, the acoustic glazing and ventilation specification can be determined by referring to Table 5.1 below.

TABLE 5.1: ACOUSTIC GLAZING & VENTILATION OUTLINE SPECIFICATIONS (LIVING ROOMS)

Daytime External Noise Level (dB)	Glazing	Ventilation
Less than 60	Standard thermal double glazing e.g. 4mm float, 16mm cavity, 4mm float (4 / 16 / 4)	1No. Vent: $D_{ne,w} + C_{tr}$ 25 dB 2No. Vents: $D_{ne,w} + C_{tr}$ 28 dB
60 to 65	6mm float, 16mm cavity, 6mm float (6 / 16 / 6)	1No. Vent: $D_{ne,w} + C_{tr}$ 30 dB 2No. Vents: $D_{ne,w} + C_{tr}$ 33 dB
65 to 70	10mm float, 16mm cavity, 6mm float (10 / 16 / 6)	1No. Vent: $D_{ne,w} + C_{tr}$ 35 dB 2No. Vents: $D_{ne,w} + C_{tr}$ 38 dB
70 to 75	10.8mm acoustic laminate, 16mm cavity, 8.8mm acoustic laminate (10.8 Ac Lam / 16 / 8.8 Ac Lam)	1No. Vent: $D_{ne,w} + C_{tr}$ 40 dB 2No. Vents: $D_{ne,w} + C_{tr}$ 43 dB

In order to determine the required acoustic glazing and ventilation specification to bedrooms, Figure 3.2 should be referred to in order to determine the night-time external noise level band at the specific dwelling location. Based on the predicted noise level band from the coloured contour plot, the acoustic glazing and ventilation specification can be determined by referring to Table 5.2 below.

TABLE 5.2: ACOUSTIC GLAZING & VENTILATION OUTLINE SPECIFICATIONS (BEDROOMS)

Daytime External Noise Level (dB)	Glazing	Ventilation
Less than 50	Standard thermal double glazing e.g. 4mm float, 16mm cavity, 4mm float (4 / 16 / 4)	1No. Vent: $D_{ne,w} + C_{tr}$ 25 dB 2No. Vents: $D_{ne,w} + C_{tr}$ 28 dB
50 to 55	6mm float, 16mm cavity, 6mm float (6 / 16 / 6)	1No. Vent: $D_{ne,w} + C_{tr}$ 30 dB 2No. Vents: $D_{ne,w} + C_{tr}$ 33 dB
55 to 60	10mm float, 16mm cavity, 6mm float (10 / 16 / 6)	1No. Vent: $D_{ne,w} + C_{tr}$ 35 dB 2No. Vents: $D_{ne,w} + C_{tr}$ 38 dB
60 to 65	10.8mm acoustic laminate, 16mm cavity, 8.8mm acoustic laminate (10.8 Ac Lam / 16 / 8.8 Ac Lam)	1No. Vent: $D_{ne,w} + C_{tr}$ 40 dB 2No. Vents: $D_{ne,w} + C_{tr}$ 43 dB

5.2 External Amenity Noise (Daytime only)

It can be seen from Figure 3.1, that external ambient noise levels across the residential areas of the site generally fall below the 55 dB(A) criterion as required by MCC to outdoor amenity areas, including terraces. There are however, plots closer to the site boundaries where the criterion will not be met; such affected amenity spaces should preferably be sited to an acoustically screened side of the plot, or, where this is not possible, the use of local or boundary acoustic screening considered.

It is worthy of mention that in keeping with the latest Planning Policies, BS 8233 'Guidance on sound insulation and noise reduction in buildings' was updated in 2014 to include the following text with regard to external ambient noise levels:

'For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a

situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.'

5.3 Mitigation Measures Summary

With appropriate mitigation, as outlined above, the site can be constructed in line with the MCC acoustic requirements whilst achieving acceptable internal and external ambient noise levels.

6. CONCLUSIONS

URS was appointed by Galliford Try Construction to undertake a noise ingress assessment for the Brunswick PFI housing scheme in Greater Manchester. The purpose of the assessment is to discharge the noise related planning condition referring to internal ambient noise levels within dwellings.

Noise models of the surrounding road network representative of both the daytime and night-time period have been produced.

The assessment, which is based on the results of the noise modelling exercise, demonstrates that with appropriate mitigation, as outlined in Section 5 above, the site can be constructed in line with the MCC acoustic requirements whilst achieving acceptable internal and external noise levels.

An entertainment noise assessment has also been undertaken which is based on a recent noise survey undertaken at the site on a gig night at the O2 venue. It has been demonstrated that with the adoption of suitable noise mitigation measures that the MCC entertainment noise requirements can be achieved.

APPENDICES

NOISE PERCEPTION AND TERMINOLOGY

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal's, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB (A). Table A1 below lists the sound pressure level in dB (A) for common situations.

SOUND PRESSURE LEVELS FOR A RANGE OF SITUATIONS	
Typical Noise Levels dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2m
50	Quiet office, no machinery Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m Vacuum cleaner at 3m
80	General factory noise level
100	Pneumatic drill at 5m
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy road, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night time noise levels will often be smaller and the levels significantly reduced compared to daytime levels.

The equivalent continuous A-weighted sound pressure level, L_{Aeq} , is the single number that represents the average sound energy measured over that period. The L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period.

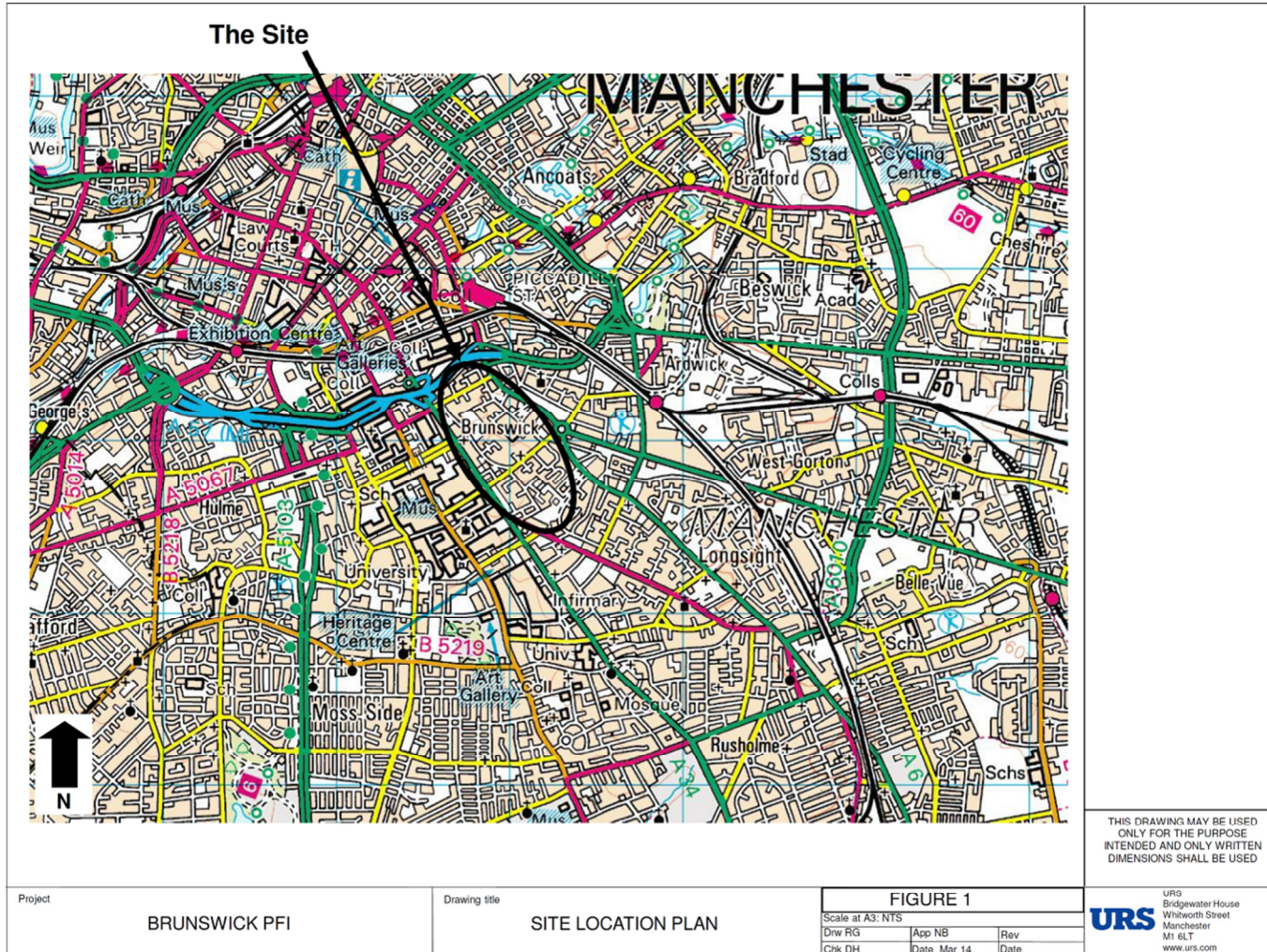
Human subjects are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

The L_{AFmax} measurement parameter is the maximum instantaneous sound pressure level attained during the measurement period (30 seconds, 5 minutes etc.), measured on the 'fast' response setting of the sound level meter. Even though sounds appear fairly steady to the human ear they are seldom if ever steady in level. To accommodate this factor, sound level meters (SLMs) are generally provided with at least two meter

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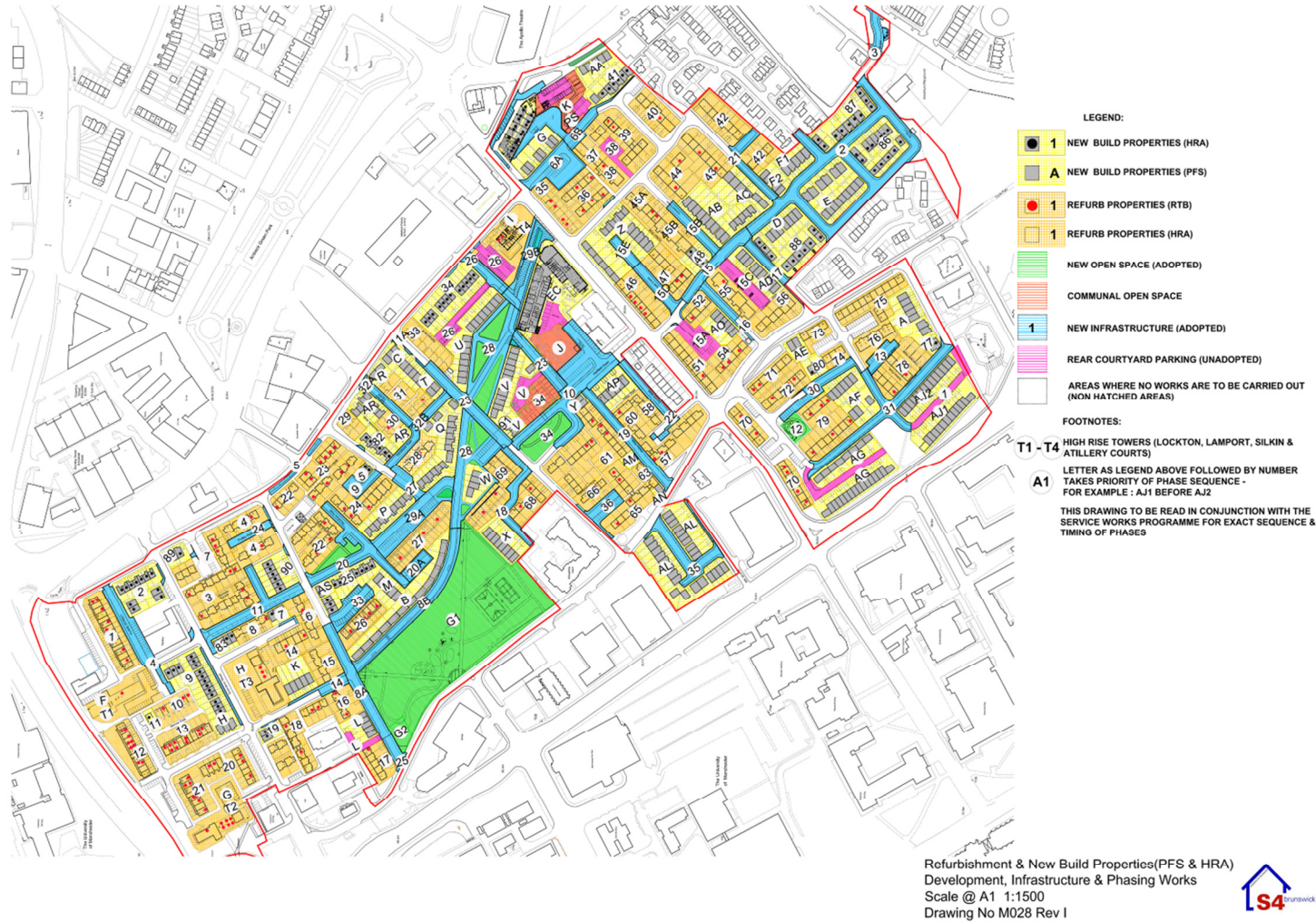
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responses or exponential averaging circuits. Fast meter response has a time constant of 1/8th of a second (125ms) and approximates the integration time of human hearing.



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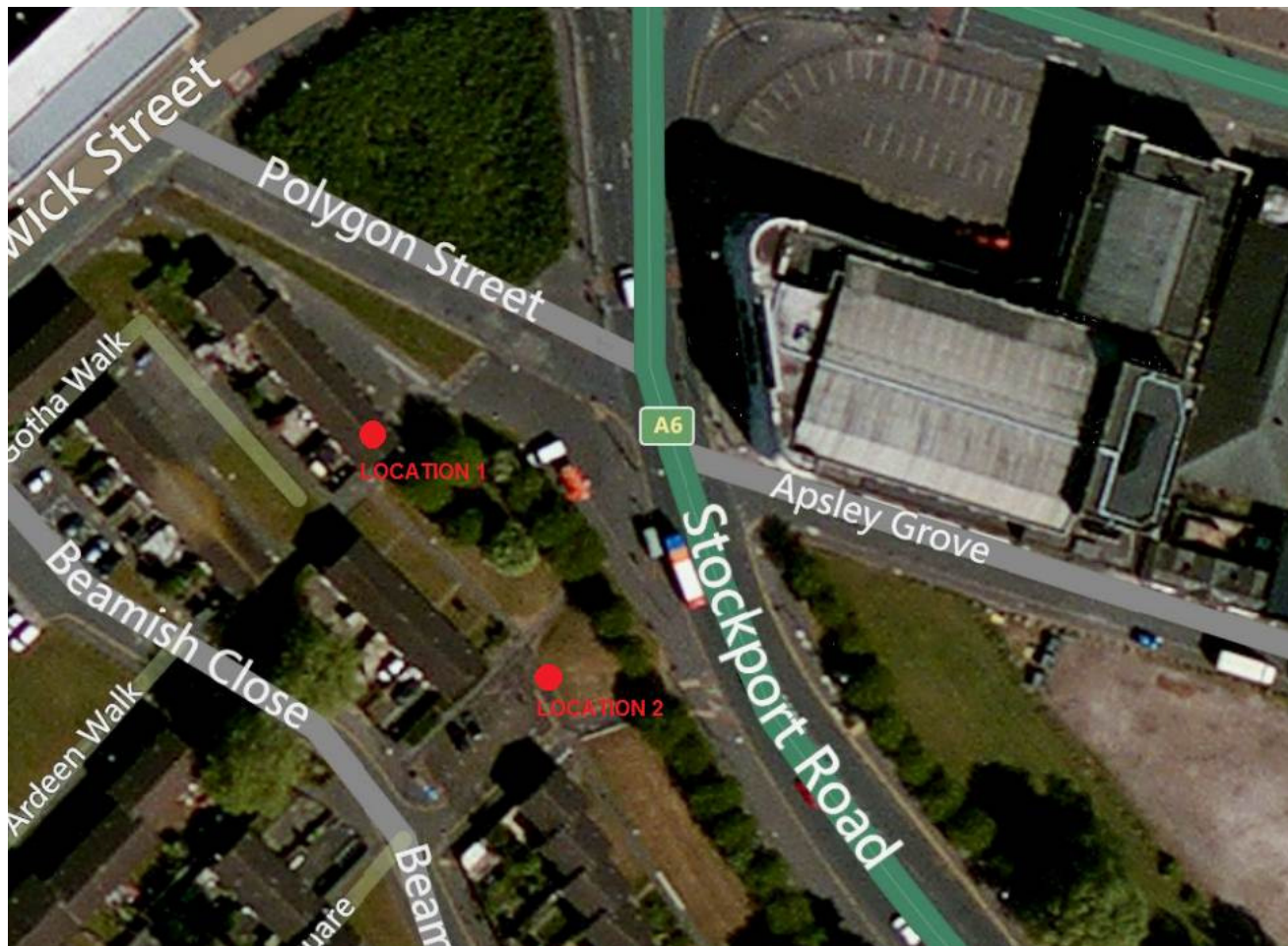
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Manchester O2 - Entertainment Noise Monitoring Location Plan



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