

Guidance Document

G148 Management of Noise due to Public Address Systems

Issue No.: A3

Issue date: April 2013

Review date: April 2016

MAYOR OF LONDON

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1 Purpose

- 1.1 The purpose of this document is to provide PA (Public Address) noise management guidance to all stakeholders involved in PA system design, maintenance, operation customer information strategy and noise complaint management. The Category 1 requirements that relate to PA systems are given in LU (London Underground) standards 1-142 and 1-180.

2 Scope

- 2.1 This Guidance applies to all Public Address (PA) systems used by LU and where their operation may cause noise nuisance to its neighbours

3 Guidance

3.1 General

- 3.1.1 PA systems should be designed, installed and operated to be compatible with requirements of relevant legislation including the Environment Protection Act 1990 (EPA) and (EA) Equality Act 2010.
- 3.1.2 All PA systems operated adjacent to residential properties should be configured and operated to minimise noise pollution whilst taking into account safety requirements.
- 3.1.3 Noise controls implemented should be documented and traceable to local /specific agreements. Deviations from these should be subject to an agreement from PANMG (Public Address Noise Management Group) and relevant standard holders.
- 3.1.4 Noise controls both technical and operational restrictions applied to sites at risk of noise complaints should be subject to risk-based assurance controls e.g. audit/ surveys to ensure effectiveness.
- 3.1.5 PA noise complaints should be managed and resolved in accordance with guidance and relevant processes provided in attachment 1 of this document.
- 3.1.6 Any conflicts that arise during the course of resolving a noise complaint should be referred to PANMG and relevant standard holders as required.
- 3.1.7 The Customer Services Centre (CSC) team dealing with PA noise complaints should hold central records for all PA noise complaints for a minimum of 3 years.
- 3.1.8 Detailed records of PAS (PA system) operation, including PA operating times, types and frequency of messages should be kept and updated as agreed by PANMG.

Note 1. This guidance focuses mainly on fixed PA systems e.g. stations /depots. Train PA complaints can be dealt with the similar noise management principles. Rolling stock engineers should be consulted for on-train PA volume problems /fixes.

3.2 Customer Information (Messaging) Strategy

- 3.2.1 The types and number of PA messages broadcast to customers in trains or in station environments should conform with TfL S&SD (Strategy and Commercial) Directorate published standards and guidelines corrected for risk of noise complaints.
- 3.2.2 Factors for consideration used to develop LU PA operating guidelines should include (particularly for surface sites) the risk of PA noise nuisance complaints. See also attachment 2 to this guidance.



- 3.2.3 Where PA operating guidelines referred to in clause 3.2.2 are linked to line-based /site specific customer satisfaction survey (CSS) scores, these may need to be reviewed depending on the effectiveness of noise controls used to prevent PA noise complaints.
- 3.2.4 Proposals to vary the PA element of the CSS should be submitted to PANMG for review.

3.3 Operational Practice - Stations

- 3.3.1 Station staff should be familiarised with site-specific restrictions that need to be observed to manage noise emissions at known / affected sites.
- 3.3.2 At noise sensitive sites all non-essential PA should be restricted after 2300 and before 0700 to minimise noise complaints. See also 1-312.
- 3.3.3 Where local conditions /risk assessment require more onerous restrictions these should be agreed by PANMG.
- 3.3.4 At noise sensitive sites except for emergencies, station and line control room staff should ensure all PA announcements (recorded or live) conform to any noise reduction measures documented and agreed between LU and the local council / residents.
- 3.3.5 For sites affected by or at risk from noise complaints, the reduction / deactivation of long-line PA should be considered.
- 3.3.6 At noise sensitive sites where 'Mind the gap' messages are used; these may need to be limited to on-train or at certain times only to manage noise nuisance.
- 3.3.7 Pre-announcement *attention drawing* chimes should be disabled to minimise noise nuisance.
- 3.3.8 Where possible fire alarm tests at noise sensitive sites should be scheduled to minimise noise nuisance to neighbours

3.4 Operational Practice - Trains

- 3.4.1 Train operator's should be familiarised with site-specific restrictions that need to be observed to manage noise emissions at known /affected sites
- 3.4.2 Platform announcements (whether by a member of staff or an automated voice announcer) should be timed to avoid coinciding with a train entering or leaving the platform or whilst an announcement is being made on the train and the train doors are open
- 3.4.3 Where possible duplication of train and station PA messages should be avoided.
- 3.4.4 Where practicable operational restrictions that apply to noise sensitive station platforms should be applied appropriately to trains stopping at these platforms.

3.5 Technical – System Assurance

- 3.5.1 In the absence of more specific guidance it is recommended that the following criteria be used as the basis for design of PA systems adjacent to residential properties.
- a) For PA system upgrades the noise emissions from the upgraded system should be limited to a rating level, as defined in BS 4142:1997 equal to or better than the rating level of the previous PA system.
 - b) For new PA systems where previous noise emission data/rating level is not available then noise emissions should not exceed the 'marginal significance' rating level of +5dB above background noise levels as defined in BS 4142:1997.



- c) In addition, LU has a statutory obligation to demonstrate that best practicable means has been adopted to minimise noise at all times. This should include both operational and technical strategies as defined in this guidance.
- d) Messaging and operational strategies to minimise noise nuisance are given in sections 3.2 and 3.3/3.4 respectively. The Technical (design / implementation) strategies are detailed in section 3.6

3.5.2 For all noise sensitive station PA systems new or upgraded the project manager / engineer should produce a “Noise Study” report. This report should be compiled to take into account the following.

- a) Noise measurements to conduct a BS 4142 noise complaints risk assessment;
 - i. Background noise measured as $L_{A90, T}$ {PA OFF}
 - ii. Residual (ambient) noise measured as $L_{Aeq, T}$ {PA OFF}
 - iii. Specific noise measured as $L_{Aeq, T}$ {PA ON}
 - iv. The average (A-weighted) acoustic transfer function between a given PA zone and the nearest noise receptor. (See also note 2; para. 3&4)
 - v. Current profile of PA announcements (where applicable)

Note 2. (applicable to Clause 3.5.2 a)

Readings i) and ii) should be taken at a position that is representative of the nearest / most sensitive noise receptor or ideally if opportunity permits at a defined noise receptor position.

Reading iii) needs to be taken simultaneously from two positions: in the PA zone and at the representative measurement position/ receptor

The *acoustic transfer function* characterises the attenuation loss between the PA zone and the noise receptor/ representative measurement position; taking into account distance, direction and contribution of reflections

The difference between the two simultaneous specific noise measurements provides an approximation of the acoustic transfer function between the specific PA zone and relevant (affected) noise receptor.

The duration T is given in BS 4142:1997 as 1 hour for daytime. In practice this can be difficult and shorter duration (5 – 15 minutes) may be more practicable.

The PA announcement profile referred to in 3.5.2 a) v) includes information details about PA operation i.e. Start and finish times for normal operation, message duration, frequency of messages per hour and message types being broadcast.

- b) Noise readings listed in 3.5.2 a) should be taken at times such that the resultant BS 4142 assessment will highlight the worst-case impact of normal PA operation. This is likely to be earlier during the morning or later during the evening when the background noise measured as $L_{A90, T}$ will be lower.
- c) For sites with a history of noise complaints and where the local council is involved in LU consultations; a detailed acoustic survey may be needed that includes the impact of tonality e.g. 1/3 octave-band analysis at the most sensitive noise receptor. See also BSEN ISO 18233 sections 5 & 6. The project manager should seek expert acoustics advice in this regard to confirm if such a survey is required.

- d) A site survey report with relevant photographs showing physical speaker layouts of PA zones in relation to adjacent noise receptors should be provided. The layouts should include speaker datasheets and positioning information. This report should include scaled OS drawings that highlight affected noise receptors.
- 3.5.3 The format and technical content of the report required in 3.5.2 should be compatible with guidance provided in BS 4142 and BS 7445 or the latest applicable standards.
- 3.5.4 Noise instruments specifications should conform to BSEN 61672 or later standards as they become available for use. In most cases for the purpose of LU records (unless specifically required or requested) a minimum noise instrument accuracy of class 2 is sufficient.
- 3.5.5 When responding to or investigating formal noise complaints made by the local council, or when readings are formally requested, Class 1 accuracy is required.
- 3.5.6 External readings should be taken in the free field at least 3.5m from reflecting surfaces and between 1.2 – 1.5m above ground/ finished floor surface.
- 3.5.7 Where measurements cannot be made in the free field, readings should be taken 1- 2m from the relevant facade or 0.5m in front of an open window. A similar method should be adopted for readings inside buildings above the ground floor.
- 3.5.8 For new PA systems the Project manager should ensure that the contractor supplying and installing the PA system provides system documentation including commissioning /maintenance manuals and as-built drawings. The documentation and drawings should include the latest configuration changes and system updates. See also section 3.6.

Note 3. See attachment 3 and BS 7445-2 / BS 4142 for further guidance on noise measurements and corrections for facade readings

3.6 Technical – Design and System Implementation

- 3.6.1 The mandatory technical requirements applicable to PA and VA (Voice alarm) systems are given in LU standard 1-142. In respect of systems operated on surface sites and some sub-surface sites (where noise emissions could reach neighbouring properties), the system design should take into account the risk of noise complaints as evaluated in section 3.5 of this document.
- 3.6.2 Particular attention should be given to sites whose BS 4142 rating level excess (above background noise) is > 0dB. The design strategies deployed to reduce and manage noise emissions at these (moderate / high risk) sites need to be fully considered. To this end the Professional Head of Telecommunications and PANMG should be consulted.
- 3.6.3 The following are key references for the design and maintenance of PA-VA systems
- a) 1-142 (LU Standard)
 - b) BS 5839-8 (PA-VA)
 - c) BS EN 54
 - d) BS EN 60268
 - e) BS 6259:1997
- 3.6.4 Guidance regarding noise measurements and noise pollution levels should be sought from the latest version of the following standards / references:
- a) BS 4142

- b) BS 18233
- c) BS 7445
- d) BSEN 61672

3.6.5 The Integrated PA system design should offer both operational and technical flexibility in providing audio customer information whilst enabling effective management of PA noise emissions. The inclusion of the following features should be considered;

- a) Access to pre-recorded (read-only) digital message libraries with the option to add and overwrite user recorded message
- b) Ability to define complex message sequences using multiple libraries
 - a)
- c) Ability to control (switch on/off) specific agreed (non-safety) messages
- d) Ability to control operating times for all key (non-safety) PA messages
- e) Use of appropriately installed directional speakers (at specific heights/ orientation)
- f) Use of switchable speaker circuits (canopy / outside canopy)
- g) Use of speakers activated by the presence of customers on the relevant platform
- h) Use of ANS (ambient noise sensors) where applicable (see 3.6.11 and 3.6.12)
- i) Night volume control (Station PA)
- j) System memory of all user set configurations (controls / messages) including user id and time of configuration changes
- k) Integration of Station and Train PA systems

3.6.6 The Integrated PA system GUI should always issue a warning prompt when any user initiated action will result in a permanent message deletion or system change.

3.6.7 The PA installer /maintainer as appropriate shall ensure in respect of the PA system;

- a) Correctly set gain structure
- b) Appropriate signal limiting/ compression to control dynamic range / headroom
- c) Appropriate level of equalisation of specific frequencies to minimise noise spill
- d) Speaker are selected, positioned and screened to minimise noise spill

3.6.8 The long-line PA where used needs to conform to 1-142 for message priority

3.6.9 Installed PA systems should be confirmed compliant in respect of noise emissions.

3.6.10 PA systems should incorporate dynamic ambient noise sensors (ANS) / controllers to regulate volume levels in environments with variable ambient noise. The signal to noise ratio (SNR) setting for the ANS should be guided by the "existing PA system" or "Noise Study" report described in section 3.5 of this document. PA systems on surface stations at risk of noise complaints should not be operated with a SNR of greater than 6dB.

Note 4. Where there is a moderate / high risk of noise complaints the PA system SNR may have to be set so that speech intelligibility is reduced when the ambient noise is higher. E.g. trains arriving, departing, standing in the platform or other external noises. The trade-off between SNR and speech intelligibility should be risk driven.



- 3.6.11 Standard “sample-hold” ANS microphones/controllers are unsuitable for surface sites with low and steady levels of ambient noise and should be avoided if there is any risk that ANS controlled PA announcements will cause noise nuisance.
- 3.6.12 At risk legacy PA systems having these types of ANS should be disabled and PA output SPL's capped. The SPL ceiling can be empirically determined using measurements suggested in section 3.5.
- 3.6.13 If ANS are to be used in fluctuating noise environments these should be designed to track ambient noise dynamically.
- 3.6.14 New or upgraded train PA systems need to comply with the Rolling Stock standards 1-180 and 2-180.
- 3.6.15 For noise sensitive sites new or upgraded train PA system output levels based on train speed should be tested for noise nuisance using “train stationary” level with doors open.
- 3.6.16 For new systems except for emergencies (where autonomous operation is needed) there should be a level of integration between the station PA system and the arriving train PA system.
- 3.6.17 An appropriate open protocol data signalling system; wired or wireless could be used to “cue” and sequence the Train / Station PA messages system to enable control of PA messages to prevent overlapping of station / train broadcasts and priority conflicts.

3.7 Technical – System Maintenance

- 3.7.1 The PAS Maintenance organisation should keep an accessible library of relevant documentation, drawings and asset records as listed in 3.7.2. This information should be kept up-to-date and managed to a standard compatible with BS EN ISO 9001:2008 and BS ISO 15489-1:2001.
- 3.7.2 The following guidance is the minimum PA system information that should be obtained and maintained;
 - a) System operation manuals
 - b) System commissioning and testing manuals
 - c) System maintenance manuals as directed /required by LU
 - d) As-built drawings, wiring schedules and system schematics
 - e) Speech intelligibility readings (STI/STIPA) for each PA zone
 - f) Sound Pressure level (SPL) readings for each PA zone
 - g) BS4142:1997 noise assessments for stations at “marginal” risk or higher.
 - h) Internal /independent (relevant) noise investigations /reports as required
 - i) List of PA faults/ complaints responded to
- 3.7.3 The maintenance organisation upon being informed of a PA noise complaint for a given station or train should conduct a survey to check/ test the following;
 - a) The system is configured to the as-built system commissioning specification and this is compliant with current LU standards
 - b) The system has not developed any fault that is causing the noise problem

- c) The user controlled settings and how many PA messages made per hour and if this conforms locally set schedule / local agreements as applicable
 - d) Site and PA system information including measured noise emissions should be captured consistently in a survey form.
 - e) Completed survey forms with recommendations should be sent to PANMG
- 3.7.4 The PAS maintenance organisation should keep records of attendance times, personnel and fault reports including work carried out, readings taken in respect of PAS faults.
- 3.7.5 PAS fault reports and readings should be consistent and follow a standard template.
- 3.7.6 PAS alterations in response to a given noise complaint should not affect its safety performance
- 3.7.7 PAS drawings / other records should be updated to reflect any alterations carried out in response to noise complaints.

4 Responsibilities

4.1 PANMG Roles

Responsibilities can be assigned to the key roles identified in this guidance as follows;

- i. CPD- Professional Head of Telecommunications; to advise on and maintain the technical content of this guidance including the PA noise management process. Approve any necessary concessions to Category 1 technical standards to resolve noise complaints.
- ii. HSE Environment advisor – to advise PANMG in respect of environmental noise guidelines / legislation and liaise with Local Council Environmental Health Officer. Maintain a list of formally issued noise abatement notices / complaints.
- iii. PANMG – PA Noise Management Group, to convene at regular intervals to review PA noise complaints with the goal of speedy / consistent resolution and minimum loss (financial / reputational) to TfL/LU.

AMS– [Area Manager Stations](#) - In conjunction with PPM/SIP conduct initial noise complaint investigation. Provide support to PANMG throughout complaint resolution as required including liaison with complainants / local council.
- iv. SIP– Service Improvement Partner – In conjunction with Area Manager Stations conduct initial noise complaint investigation. Provide support to PANMG throughout complaint resolution as required including liaison with complainants / local council.
- v. S&SD Customer Information Manager – To chair and manage PANMG meetings. Coordinate PANMG agreed actions/decisions in respect of noise complaints. Coordinate approvals of any necessary concessions to resolve particular noise complaints both operational /customer –related and technical. Agree across PANMG members and jointly own the TOR (terms of reference) document with Professional Head of Telecommunications.