

AVIATION NOISE IMPACTS ON THE HISTORIC ENVIRONMENT

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1 INTRODUCTION

In spring 2014 Temple Group Ltd (Temple) in partnership with Cotswold Archaeology were commissioned by English Heritage to develop a methodology to analyse the noise impacts of airport expansion in the south-east of the UK on the surrounding historic environment. This paper provides a summary of this project.

2 NOISE AND HERITAGE ASSETS

2.1 What is a Heritage Asset?

The National Planning Policy Framework (NPPF) defines a heritage asset as follows:

“A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage asset includes designated heritage assets and assets identified by the local planning authority (including local listing)”.

2.2 Development Pressure

The issue of development pressure on heritage assets is identified in the National Heritage Protection Plan as Activity 2A1 which states:

“Many of England’s historic settlements, both urban and rural, are undergoing considerable change. Pace of urban redevelopment and reorganisation of housing provision strategies will have significant impact on heritage. Action will seek to facilitate strategic resource planning and engagement with partners and stakeholders in those places which are (1) undergoing most change, (2) most sensitive to change, and (3) least resourced to manage change. Research on the degree of likely change through planning applications, master planning and other activities, linked to the spatial distribution of heritage assets in those areas, will be used to develop methodologies and tools for guiding sustainable change and minimising negative impacts.”

2.3 Setting and Significance of Heritage Assets

There already exist a number of recognised methods and metrics for assessing the impacts of aviation noise on the health, quality of life and well-being of persons; but nothing similar exists in regard to heritage assets, and in particular their setting and significance. The intended output of this project was a methodology that could potentially form part of the Airports Commission’s appraisal of their shortlisted proposals for airport expansion.

Setting is not a heritage asset, nor a heritage designation. Its importance lies in what it contributes to the significance of the heritage asset. This depends on a wide range of physical elements within, as well as perceptual and associational attributes, pertaining to the heritage asset’s surroundings. Each of these elements may make a positive or negative contribution to the significance of the asset, or be neutral.

No national planning policies or guidance documents deal in any meaningful detail with the potential harm that new noise, or appreciable increases in noise levels, can have on heritage assets. However, the following documents do include elements within their policies and guidance that allow ‘heritage and noise impacts’ to be contextualised within the decision-making process:

- Planning (Listed Buildings and Conservation Areas) Act (1990);
- Ancient Monuments and Archaeological Areas Act (1977);
- National Planning Policy Framework (2012);
- National Planning Policy Guidance (2014);
- English Heritage Conservation Principles: policies and guidance for the sustainable management of the historic environment (2008);
- English Heritage the setting of heritage assets: a guidance document (2011)

Additionally the potential for noise to harm setting is recognised in case law¹ which acknowledges that non-physical or indirect harm can be caused to setting.

There is no doubt that absence of noise² and the presence of sound contribute to the sense of place or setting of many heritage assets, whether through accident or design. For example, churchyards, burial mounds, ruined buildings etc. can all have a very distinct sense of place which is at least partially the result of the absence, or at least recession, of the invasive sounds of day-to-day modern life. Consequently, it is considered that there is scope for discussion of negative noise and positive sound impacts upon heritage assets within the existing legal framework enshrined in the NPPF and other documents.

The glossary to the National Planning Policy Framework defines the setting of a heritage asset as:

“The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.”

The same glossary also defines Significance (for heritage policy) as:

“The value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset’s physical presence, but also from its setting.”

The English Heritage guidance document The Setting of Heritage Assets comments in several places that noise can be a factor influencing the setting of a heritage asset e.g. in the key principles whilst reinforcing that visual aspects are often important, the document also states that *“the way in which we experience an asset in its setting is also influenced by other environmental factors such as noise, dust and vibration;”*.

The magnitude of impact of noise can be defined as the absolute noise level from a development i.e. how loud it is; and/or any change in noise levels at a heritage asset or group of assets due to the development. In this case it was decided that the absolute aviation noise level, subject to lower limits, can be used where a heritage asset is currently unaffected by aviation noise; and the change in aviation noise level, subject to lower limits, can be used where a heritage asset is currently affected by aviation noise, but will be subject to lower or higher aviation noise levels as a consequence of the Airport Commission’s final recommendations.

However, one complication in developing a methodology is that there is no attributable correlation between a heritage asset’s sensitivity to noise and any of the following factors that may apply to the asset:

¹ E.g. Bedford Borough Council v Secretary of State for Communities and Local Government & NUON UK Ltd Second [2013] EWHC 2847 (Admin)

² Noise is often defined as “unwanted sound”.

- i. statutory protection;
- ii. designated status i.e. listing grade; or ,
- iii. perceived local value afforded to the asset.

For example a Grade I listed building is not necessarily more noise sensitive than a Grade II* or II listed building, and an undesignated asset with perceived local value may be more noise sensitive than either. Any attempts to derive a relationship between these factors, without an explicit expression and understanding of what makes the heritage asset significant, is subject to substantial uncertainty and should be avoided.

However, if a proposed development (that results in increases in noise) is deemed to cause harm to a heritage asset, the scale of that harm and the relative significance of the heritage asset should influence the judgement of the 'planning balance' used in deciding if the benefits of the proposed scheme outweigh the harm it causes; where the more significant the asset, the greater the weight should be afforded to its conservation or protection.

3 GENERAL DESCRIPTION OF METHODOLOGY

The methodology developed to assess the impact of aviation noise on heritage assets progresses using the following steps, which are illustrated in the flow chart in **Figure 1**:

1. Scoping – the heritage assets with the potential for a noise impact are identified through a process of scoping using the National Heritage List and predicted noise change contours.
2. Sensitivity of Asset – the heritage assets which are identified in the scoping exercise are categorised according to how the sound environment contributes to the significance of the heritage asset. The assets which qualify within these categories could potentially be adversely effected (or benefit) from changes to the sound environment.
3. Detailed assessment – Heritage statements of significance, informed by an analysis of the existing sound environment would be assessed when an understanding of the nature of the noise change is known. .

This methodology is described in further detail below.

3.1 Scoping

The aim of the scoping exercise is to define which heritage assets are to be assessed and which of those are likely to experience a change in the ambient noise environment due to proposals from the Airports Commission on the future expansion of airport capacity in the South East of England. The scoping exercise uses a geographical information systems (GIS) approach. Datasets identifying heritage assets including location information are obtained and mapped. A footprint (the noise change footprint) which covers all locations where there may be a change in aviation noise is derived from information provided by the Airports Commission appraisal. All designated heritage assets within the footprint are then identified as having the potential for a noise impact on their significance.

The two footprints showing locations of a potential positive change noise conditions are combined to form the final 'positive change in aircraft noise conditions scoping footprint'.

The two footprints showing locations of a potential negative change noise conditions are combined to form the final 'negative change in aircraft noise conditions scoping footprint'.

The two footprints will be overlaid in GIS over the identified heritage assets to give two lists of heritage assets which may have a positive or negative change in aircraft noise conditions. Each of the heritage assets in the lists will then be assessed as to whether the noise environment is important to the significance of the asset; this is described in the following section.

3.2 Potential Sensitivity of Heritage Assets

The assessment of a heritage asset's sensitivity to noise is informed by a qualitative, thematic approach to understanding how the noise environment can specifically contribute to the experience of the heritage significance of the asset. A heritage asset which may be sensitive to the sound environment will qualify within one of the categories below; if they do not qualify, then the assets heritage significance is not deemed to be sensitive to changes in noise. Please note that the examples of heritage asset type are provided for illustrative purposes only, this is not a definitive list.

- A. When solitude, embedded with quietness, is intrinsic to understanding the form, the function, the design intentions and the rationale for the siting of a heritage asset e.g:
 - Hermitages and retreats;
 - Monastic sites e.g. those associated with Cistercian Order;
 - Most places of worship;
 - Components of designed landscapes; and
 - Memorials and graveyards.
- B. When a non-quiet and specific existing soundscape forms part of the functional understanding of the heritage asset e.g:
 - Working windmills (the sound of grinding machinery and 'whoosh' of the sails / blades)
 - Industrial sites e.g. working furnaces and workshops;
 - Open air theatres;
 - Specific areas within places of worship e.g. bell towers and chanting halls; and
 - Cascades and fountains.
- C. When the abandonment of a heritage asset; a monument, building or landscape, in antiquity (or more recently), has created a perceived 'otherworldly romanticism' enabled by the absence of anthropogenic sounds (quietness) e.g:
 - Battlefields; and
 - Ruinous remains of former:
 - Estate houses;
 - Amphitheatres;
 - Factories and workshops;
 - Collieries and mining landscapes;
 - Designated Medieval Villages (DMVs);
- D. When the absence of "foreign" i.e. modern, sounds' allow an asset to be experienced at 'a very specific point in time' that is intrinsic to understanding the heritage assets significance. This could be associated with e.g:
 - The period of the monument or buildings construction;
 - A key moment intrinsic to the heritage asset's 'story', i.e. its association with an important historic individual or event;
 - An important phase of its redevelopment; and
 - It's abandonment or destruction.

The approach advocated above does not allow for a heritage asset's sensitivity to noise to be 'ranked' or any relative scoring of sensitivity to be applied; this approach functions within the rationale that soundscape *either contributes to heritage significance or does not*. However, the different categories of asset do differ in their capacity to accept change i.e. in their tolerance to the introduction of noise or increased levels of noise. This tolerance can be determined following more detailed assessment of the heritage assets significance and the existing soundscape at each asset.

4 DETAILED ASSESSMENT

Once a heritage asset has been identified as being sensitive to a change in environmental noise (in this case aviation noise), further assessment can be made. The assessment will be based on observation made at the site of the heritage asset, which will help inform what aspects of the noise/sound environment are important to the setting of the heritage asset, and therefore what impact the change might have.

4.1 Aspects of the Noise Environment Important to Setting

Before the site visit can be carried out initial identification of the aspects of the noise/sound environment which are important to the significance of the heritage asset will need to be carried out to inform the noise survey.

The scope of the noise survey will be informed by factors including:

- Locations at which setting may be experienced. These locations will inform the locations noise monitoring will be carried out. Whilst it may not always be possible to survey precisely at the sensitive location, alternative locations may be used to establish typical conditions.
- Times at which acoustic aspects of the setting may be important. This will inform the time of year, week or day when measurements are carried out. The noise survey, ideally, would take place during the sensitive times of day for the specific heritage asset.
- The expectation of the existing noise environment which led to the assumption at this stage that the noise environment is important to the setting should be ascertained prior to the survey. This may include specific sounds which may be important for noise sensitivity category B or D, and any existing contributions of ambient noise/sound climate, or aspects of it, to the heritage setting, based upon the acoustic environment, for example.

4.1.1 Existing Noise and Future Aircraft Noise Impact on Setting

The assessment should progress by comparing the existing noise and assessing whether the introduced aircraft noise will change the baseline impact e.g. if the noise survey shows that road traffic noise already influences the setting of the heritage asset then the introduction or intensification of aircraft noise might not change the existing noise impact. Heritage assets fitting into categories A, B, C and D will respond differently to existing noise sources, and also to changes in the existing noise environment, as discussed above, the tolerance to noise changes will vary depending on the category.

The noise survey results, combined with any predicted changes likely to occur at the time of the 'do minimum' scenario, should be used to inform the assessment of the existing setting of the heritage asset.

Future changes to the noise environment should be assessed using noise level predictions.

4.1.2 Category A & C Assessment

It is important to assets falling into Category A and C to have relatively quiet sound environments. It is also important to note that how often any distractions occur within the setting. The impact on the setting of the heritage assets in Category A and C that may be caused by the noise can be described as follows:

- **Highly adverse impact** to the setting will result when noise is often highly disturbing during sensitive times.
- **No impact** to the setting will be caused when noise is either not noticeable, or just noticeable occasionally during sensitive times (i.e. there is respite from the just noticeable noise).

- **Adverse impacts** may be caused between these two categories depending on how disturbing the noise is (disturbing / highly disturbing) and how often this occurs.

4.1.3 Category B & D Assessment

It is important for the setting of assets falling into Category B and D to be able to hear specific sounds within the noise environment. It is therefore important how much the specific sound is interfered with by other sounds in the soundscape, from other sounds being just audible, to the specific sound that informs the setting being masked. It is also important to note that how often any interference occurs is important to the setting. The harm on the setting of the heritage assets in Category B and D that may be caused by the noise may be described as follows:

- **Highly adverse impact** to the setting will result when noise is often masking the specific sounds which are important to the setting during sensitive times.
- **No impact** to the setting will be caused when noise is either not audible, or just audible alongside the specific sounds, whilst not interfering with them occasionally during sensitive times (i.e. there is respite from the noise).
- **Adverse impacts** may be caused between these two categories depending on how much the noise interferes or masks the specific sounds and how often this occurs.

5 QUANTITATIVE ASSESSMENT

In the descriptions above there are a number of qualitative measures used to describe the impact of the environmental noise (such as when noise becomes 'disturbing'). These may be assessed quantitatively using thresholds e.g. a benchmark noise level when noise becomes disturbing; however the quantitative thresholds may vary depending on the specific asset, the existing noise environment, and the person experiencing the setting (given that the thresholds are likely to be subjective).

Below gives some guidance on how some of the qualitative measures given above might be quantified:

How disturbing the noise is: This may be described by an absolute noise level threshold informed by existing aircraft noise studies:

- Above 66 dB $L_{Aeq,T}$ (T is the sensitive time period identified) – aircraft noise is likely to be highly disturbing to most people.
- Below 54 dB $L_{Aeq,T}$ – aircraft noise is not likely to be disturbing to most people.
- Between the two extremes, noise may be disturbing to a greater or lesser proportion of the population depending on the noise level.

How much the noise is interfering with the specific noise: This may be described by a threshold change in noise level combined with a minimum noise levels, also informed by existing aircraft noise studies:

- Increase above 10 dB $L_{Aeq,T}$ with a minimum of 57 dB $L_{Aeq,T}$ – aircraft noise is likely to mask or interfere with the existing noise.
- Increase of less than or equal to 1 dB $L_{Aeq,T}$ with a minimum of 54 dB $L_{Aeq,T}$ – aircraft noise is not likely to interfere with existing noises in the noise environment.
- Between the two categories, noise may interfere with the specific noise sources in the setting, and may mask quieter specific noises during fly over.

How often the noise disturbance or interference occurs: This may be described by both how often the location may be overflown in any one mode of airport operation (e.g. number of flights per hour with westerly aircraft departures) and how often the airport might be overflown given the anticipated changes to modal operations throughout the year (e.g. only overflown on easterly departures and this accounts for 25% of the year).

- Modal operations leading to over flights for 75% of the year or more and number of flights over L_{Amax} of 70dB (N70) of greater than 100 a day could be described as 'often'.
- Modal operations leading to over flights for 25% of the year or less and/or number of flights over L_{Amax} of 70dB (N70)³ of less than 20 a day could be described as 'occasional'.

6 HARM TO HERITAGE SIGNIFICANCE

The preceding sections have developed an understanding of the significance of a heritage asset's tolerance to change to its soundscape. The final consideration in the assessment process is whether this change would constitute harm⁴ to heritage significance and ultimately, an expression of the weight that this harm should be afforded in determining the sustainability of a proposed scheme.

The NPPF, paragraph 132, states that *"When considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting."*

The same paragraph goes on to state that *"Substantial harm to or loss of a grade II listed building, park or garden should be exceptional. Substantial harm to or loss of designated heritage assets of the highest significance, notably scheduled monuments, protected wreck sites, battlefields, grade I and II* listed buildings, grade I and II* registered parks and gardens, and World Heritage Sites, should be wholly exceptional."*

Paragraph 134 states that *"Where a development proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal..."*

Therefore, although it is recognised that *substantial harm* is a key defining threshold to understanding the weight that should be attributed to determining the suitability of development proposals, it is also necessary to recognise that an impact of *less than substantial harm* can also influence the decision making process

Neither the NPPF nor NPPG provide a definition of *substantial harm*, although several recent High Court and Planning Appeal decisions have sought to explore the concept. The consensus that is emerging from these decisions is that in the context of physical harm, *substantial harm* would apply in the case of demolition or destruction of a heritage asset, i.e. total loss. It would also apply to a case of serious damage to the structure of a monument, building or historic landscape. In the context of change within the setting of a heritage asset (such as aircraft noise) the test is effectively the same, i.e. where the change would have such a serious impact that the significance of the heritage asset was either vitiated altogether or very much reduced. When the experience of a heritage asset is clearly affected, but not to the scale defined above, this would constitute less than *substantial harm*.

³ Research has found that the maximum sound pressure level (L_{Amax}) and the percentage of natural features present at a location were key factors influencing perceptions of tranquillity - The acoustic and visual factors influencing the construction of tranquil space in urban and rural environments tranquil spaces-quiet places: R Pheasant, K Horoshenkov, G Watts and B Barrett; J. Acoust. Soc. Am. 123, 1446 (2008).

⁴ Not all changes will necessitate harm; proposals can bring about changes to the soundscape that would enhance the heritage significance of assets i.e. reduction in noise levels or the frequency of noise events.

7 CONCLUSIONS

The study highlights that existing means of assessing aviation noise can be used to assess the impact on the physical structure of heritage assets and on persons living or working at heritage assets; but confirms there are no established methods for assessing the impact of noise on the setting of heritage assets. The study therefore focused on this aspect of the study.

The output of the project is a methodology for assessing the impact of aviation noise on the setting of heritage assets that can be summarised as follows:

1. Use airport noise contours and noise information to identify the spatial scope of the study based on defined absolute noise levels or changes in noise levels.
2. Use Geographic Information System (GIS) databases to locate heritage assets within the spatial scope of the study.
3. Screen the identified heritage assets into a non-noise sensitive and four noise sensitive categories.
4. Overlay the noise information on the GIS layer with the identified noise sensitive heritage assets.
5. Screen out those heritage assets where a noise impact is unlikely due to the absolute noise levels or any change in noise levels not being sufficient to have a beneficial or adverse effect.
6. Undertake a detailed site specific assessment of the noise impacts on the remaining noise sensitive heritage assets where the absolute noise levels or change in noise levels has been identified as potentially sufficient to have an adverse effect. This detailed appraisal will take into account factors including the following:
 - a. The nature, character and level of existing ambient noise levels,
 - b. The type of noise sensitive category the asset falls within,
 - c. How frequently and for how long the aviation noise is likely to occur,
 - d. How high is the absolute level of aviation noise or how big a change in aviation noise is expected,
7. The outcome of the method is an appraisal of whether the impacts of aviation noise or any changes in aviation noise are likely to be beneficial, neutral, or cause substantial harm or less than substantial harm to the setting of heritage assets.

The project included case studies of the use of the methodology, and describes the assumptions used and the limitations of report.

Recommendations have also been made for further work that will improve the understanding, assessment and mitigation of aviation noise impacts on heritage assets. Including possible further work utilising sensor networks and fuzzy logic software capable of distinguishing different noise and sound types, coupled with input from visitors on which noises detract and what sounds contribute to the setting of various heritage assets. To broaden the understanding of the positive and negative soundscaping elements which contribute to or detract from the setting of heritage assets.

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Figure 1: Flow Chart of a Method for Assessing the Significance of the Effect of Noise on the Setting of a Heritage Asset

