



Exploring the concept of fair and equitable distribution to minimise social unacceptability of airspace design options

Summary of Research – Shortened

The information provided in these slides specifically refers to research undertaken by Anderson Acoustics and Manchester Metropolitan University for London Gatwick, and should strictly not be re-purposed, taken out of context, or misused.

FED2 Purpose and objective

Campaign groups around Gatwick Airport advocate for a “fair and equitable distribution (FED)” of aircraft noise, a policy sought since 2016. The CAA's CAP1616 framework prioritises reducing significant adverse effects of noise which can result in concentrated aircraft routes and has often been met with adverse local community response. Current UK policy lacks specific FED guidance, focusing instead on mitigating aviation noise impacts.



Purpose

To understand how airspace design options influence those features that impact perception of fairness and equity **to inform more socially acceptable airspace modernisation.**

FED2



Objective

To conduct an in-depth qualitative assessment, working directly with aviation and community stakeholders, **to define the performance features and their metrics that influence perception of concepts of fairness.**

FED2 Research Journey

How can we combine these outcomes to help evaluate relative risk of social unacceptability

Community Insight (Qualitative Path)



What people feel and experience

- **Focus Groups** – 130+ participants with varying aircraft noise exposure
- **Exploration of Fairness** – Distributional, procedural, and informational fairness
- **Virtual Airport Testing** – Four noise distribution concepts tested
- **Hierarchy of Risk** – Identified what communities see as fair or unfair
 - Minimal change = lower risk
 - New exposure/concentration = higher risk

Quantitative Evidence (Data Path)



What the data shows

- **Noise Event Metrics (N65)** – Better reflect lived experience than Leq
- **Person Event Index (PEI)** – Combines event count with population affected
- **Risk Quantification** – Metrics align with perceived fairness risks
 - Change in N65 exposure = key to fairness
 - Higher PEI = higher social risk
 - PEI 'No Change' = lowest risk
- **Spatial Mapping** – Visualises who gets more or less noise

More Transparent, Fair, and Acceptable Airspace Design

Combined into a Supplementary Framework to complement CAP1616 decisions

A tool to help airports **assess options transparently**, address **community concerns through engagement**, and reduce the risk of **socially unacceptable outcomes**

Why this matters



Aircraft noise distribution is a major driver of community opposition to airspace change.



CAP1616 prioritises aggregate noise impact reduction, but fairness linked to distribution.



FED2 explores reducing the relative risk of socially unacceptable outcomes by addressing fairness.

Key work stages

Q Methodology

An innovative approach helped to reveal the influence of attitudes, including understanding potential groupings of common attitudes, and preferences on the perception of fairness

Oct 22

Feb 24

Expert Review Group (ERG)

Four members with diverse experience reviewing tasks, progress, outcomes, additional considerations, and project report.

Stakeholder Focus Group (SFG)

CNG Fundamentals Workshop (CFW)

Community Fundamentals Workshop (CFW)

Workshops gathered feedback from key stakeholders on features, concepts, and barriers to mitigating aircraft noise. Used to develop test material for FG's.

Focus Groups (FG)

13 community focus groups, engaging over 130 members, and used a virtual airport to explore concepts.

Development and testing of supplementary approach

Final report published end of 2024

Concepts of fairness

Social justice research distinguishes between different forms of fairness.

Distributional fairness

With aviation noise decisions, this relates to individual response or judgment on the **fairness of the (change in) distribution of overflight or noise burden across a geographical area or population – weighing up perceived benefits and dis-benefits** of a change.

In this context this is not monetary judgement (in the traditional cost-benefit analysis sense – although this may feature in compensation discussions).

Procedural fairness

People are not only concerned with the outcomes of a decision, but, more importantly, with the procedures that lead to the decision.

Research on the fair process effect suggests that **a fair process might have more influence on the overall fairness evaluation than the outcome itself.**

Informational (and interpersonal) fairness

Informational fairness describes the quality of the explanations given to the affected people that justify the reason for the application of a certain decision-making procedure or the distribution of the outcome in a certain way.

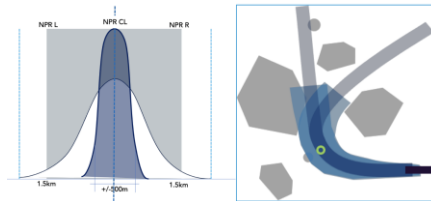
Interpersonal fairness focuses on the degree to which people are treated with politeness, dignity, and respect by the decision-making party.



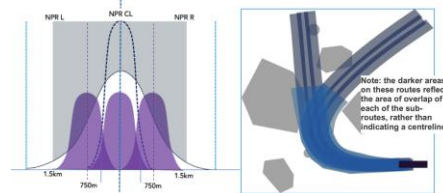
Use of virtual airport critical to success of FGs

Use of a virtual airport to illustrate different aircraft distributions and their consequences for noise changes on the ground enabled participants to reveal their underlying motivations and concerns.

1. Replication of the conventional route

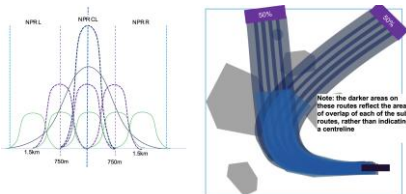


2. Limited dispersal of movements across the NPR

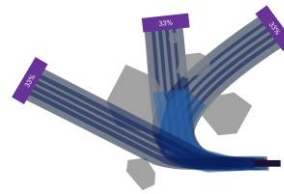


Removing reference to specific locations reduced NIMBY bias and **enabled discussions to reflect on the overall fairness** for different patterns of increases and decreases in aircraft noise event outcomes.

3. Wider dispersal within the NPR



4. Extensive sharing via a new route

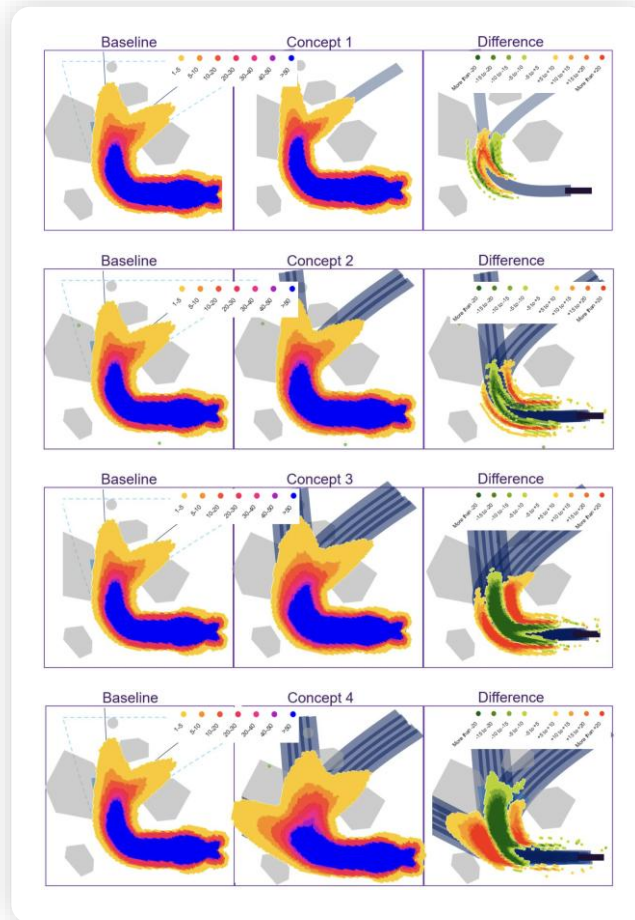


Participants were willing and able to express preferences for different distributions of aircraft, and it **became possible to link these preferences to changes in an objective noise metric (N65s)**

A role for event-based metrics highlighted

Spatial presentation of N65 changes enabled understanding of important features of noise distribution that influenced perceptions of fairness – shedding light on relative merits of alternative options for distribution of aircraft.

- N65 metric easily understood - reflecting perception of community experience of aircraft noise.
- N65 sensitive to relatively small changes in aircraft lateral distribution within a route that are not picked up by Leq.
- Spatial change in N65 highlights areas experiencing increases or decreases in events resulting from a change in distribution of aircraft movements. These change patterns were understood and reflected community perceptions of distributional changes and impact.
- Power to illustrate the geographical extent and consequence of concentration and sharing regimes.



- Illustrate important features of noise distribution changes influencing perceptions of fairness - offers opportunity to enhance transparency around consequences of ACPs.
- Overlaid with pop data, could be extended to quantifying benefits/disbenefits by calculating changes in number of person events thereby contributing to decision-making around compensation/mitigation based on a full understanding of the locations and populations adversely affected by distribution changes in the distribution
- Change illustrations support transparent engagement critical to informational and procedural fairness.

Understanding Distributional fairness

Fair and/or equitable?

The **perception of distributional fairness** was **dominated by the extent of change from that currently experienced, NOT establishment of more even (equitable) distribution of noise events.**

Local people were consistent in indicating there is an **underlying assumption that all the Balanced Approach possibilities would be utilised to minimise the noise impact** of any lateral distribution options discussed (quieter aircraft, optimised departure and arrival vertical profiles, etc).

Change in spatial distribution of aircraft noise (events) lies at the heart of perceptions of fairness

Airspace designs that result in **minimal change in the redistribution of the burden of aircraft noise** (presented as changes in event-based metrics) **and ideally reduce the burden for those that are already most affected** are at **lower risk of being perceived as distributionally unfair, and socially unacceptable.**

In airspace design terms this implies, limited spreading over already overflowed areas is likely to be more acceptable than concentrating flights or introducing them to new areas.

There is a spectrum of social risk linked to perceptions of distributional fairness

Risk is lowered with some form of limited sharing that more closely reflects the existing distribution of the noise burden, whilst delivering noise reduction for those who are most exposed.

Risk is higher with more geographical extensive sharing and/or when new people are exposed to aircraft noise, or when those who are currently burdened the most, take an increase in noise exposure (increased concentration).

Unfair for health burden to increase

It was widely agreed that increasing noise for those already most at risk of health impacts is unfair—even if more people overall experience lower levels.

The latter was regarded as a fairer outcome **ONLY** if the burden on the most exposed is reduced along with the associated risk of adverse health outcomes.

Secondary features influence acceptability and moderate risk

While the geography of noise redistribution was most important, other factors also shaped perceptions of fairness—such as land use, rural vs urban areas, and how changes aligned with expectations of living in a place.

Their impact on risk isn't fully clear and may only emerge when specific proposals are discussed with communities.

Caution on wider sharing to provide relief/respite

The fairness of wider noise sharing and its link to relief/respite or compensation remains unclear and may only become evident through community discussions. Respite should be presented cautiously as a benefit, especially to those not currently affected by aircraft noise.

Spectrum of risk of of social unacceptability associated with the perception of Distributional Fairness

Airspace designs that result in **minimal change in the redistribution of the burden of aircraft noise** (presented as changes in event-based metrics) **and minimise increases for those that are already most affected** are at **lower risk of being perceived as distributionally unfair, and socially unacceptable**.



Informational and Procedural Fairness

Study highlighted the role of informational and procedural fairness during overall engagement processes in reducing risk of socially unacceptable airspace redesign.

An environment of mistrust

Focus group comments revealed mistrust linked to past airport changes. CAP1616 must operate transparently to rebuild trust and reduce resistance to future decisions.

Event-based metrics – meaningful and relatable

Noise event metrics proved more meaningful and relatable than average levels, reflecting residents' lived experience. Their use supports informational fairness and helps build trust in airspace decision-making.

Event-based metrics – greater depth to negotiation

Event-based metrics offer deeper insight to support negotiations on the suitability of airspace change options, including 'concentrate and avoid' approaches.

Realising contributions to informational and procedural fairness

Genuine options

To build trust and enable meaningful engagement, airspace change sponsors must present a range of genuine, viable options with clear, transparent illustrations of noise impacts. This allows full scrutiny and empowers communities to share informed preferences.

Influence over final decision

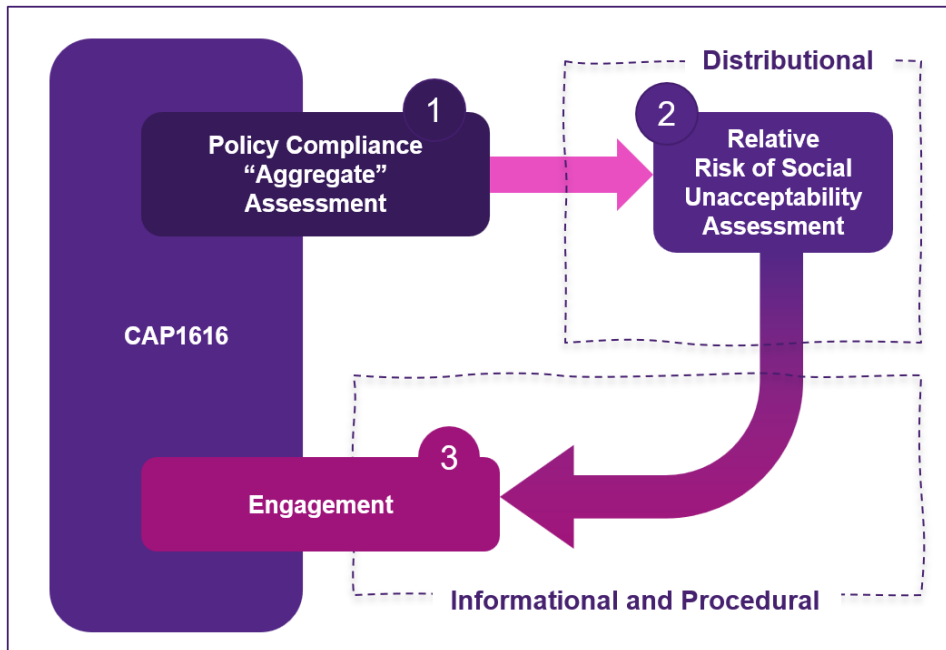
Providing opportunity for these preferences to influence the final decision over the selection of specific ACPs should enhance procedural and informational fairness, contributing to more socially acceptable outcomes and, over time, helping to rebuild trust in aviation authorities through demonstrably supporting social justice.

Growth could erode benefits

Focus groups raised concerns that future traffic growth could undermine the benefits of noise sharing. To ensure transparency, growth projections must be included in discussions and decision-making.

Considering the dimensions of fairness alongside existing CAP1616 assessment

Not a challenge to policy



This study is intended to support existing policy by enhancing transparency and engagement. Through developing a better understanding of residents' key concerns, it proposes a complementary framework using clear, event-based metrics to help communities understand the impacts of airspace options.

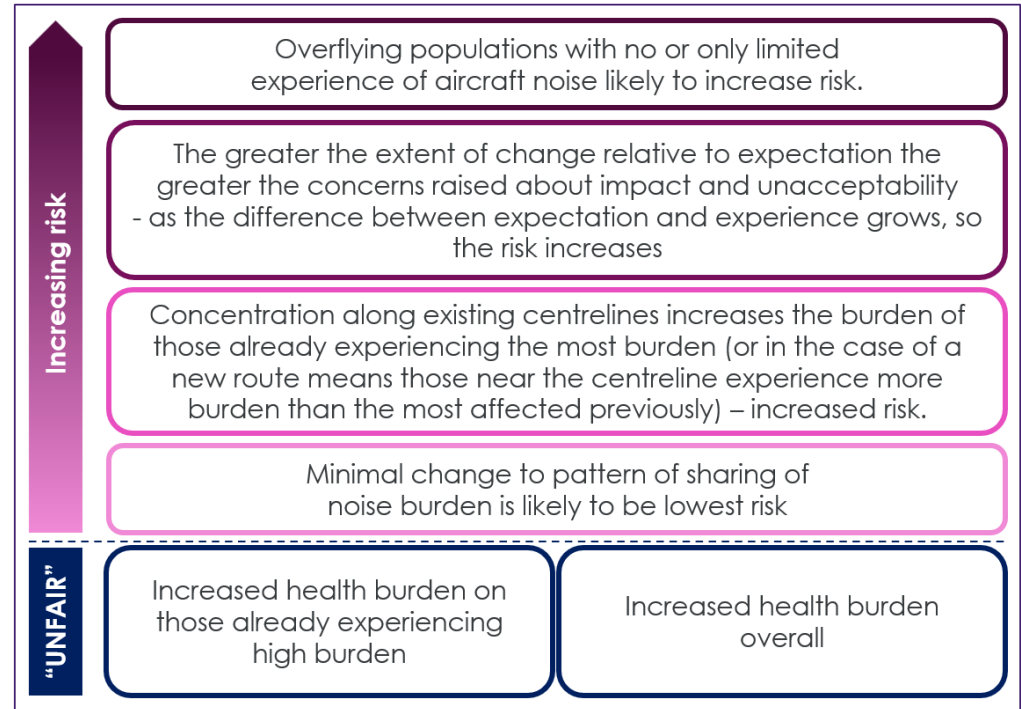
While not a decision-making tool, the framework supports existing processes by improving openness around the social acceptability of noise changes—ultimately helping to deliver less socially unacceptable outcomes.

It should also not be considered as a framework that will deliver a universally accepted solution.

Hierarchy of risk factors

The study found that communities around Gatwick Airport see fairness not as evenly sharing aircraft noise, but as minimising changes to existing patterns and reducing noise for those already most affected.

The hierarchy of risk shows that new exposure, increased concentration, and changes that conflict with expectations are more likely to be seen as unfair and socially unacceptable. Minimal change carries the lowest risk.

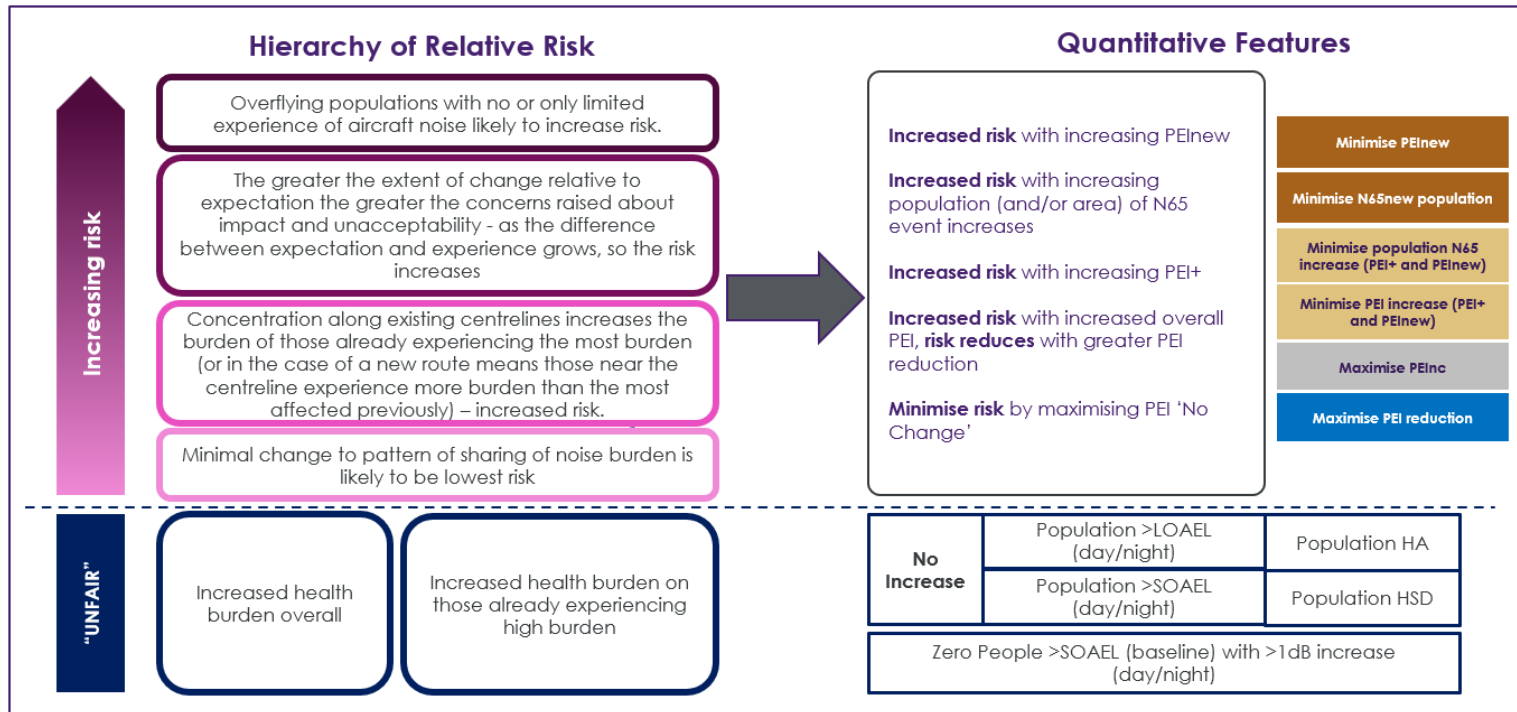


Framework steps summary

Steps for assessing and communicating the distributional consequences of airspace change proposals.



STEP 8 uses our hierarchy of relative risk and aligns with the quantitative features N65 and PEI and their change



This framework illustrates how different airspace design choices carry varying levels of social risk. Minimal changes to existing noise patterns are seen as least unfair, especially when they reduce noise for the most affected. In contrast, concentrating flights or introducing noise to new areas increases risk—particularly where changes conflict with people’s expectations.

The right-hand side shows how quantitative metrics like PEI and N65* (derived from **Steps 1 to 7**) can be used to assess and compare options, helping to highlight which proposals carry a higher or lower relative risk of being socially unacceptable as evaluated in **Steps 9 and 10**.

*Details of PEI and N65 metrics in full report with illustrative case study

Recommendations for airports

- ✘ **Implement this supplementary framework to complement the policy-based approach already undertaken** (it is recognised that the extent to which it is applied will need to consider existing and proposed airport size and impacts).

- ✘ **Undertake a two-step community engagement process.**

Step A - to establish the preference for different patterns of change in the distribution of aircraft noise arising from a range of airspace change scenarios (using a virtual airport setting may assist this dialogue). This could also be used to test the event threshold metric (e.g. N60 or N65) and associated bandings.

Step B - more generalised engagement that then seeks views on specific selected options following application of the learning from step A. This could form part of the main ACP consultation at Stage 3.

- ✘ **Use the outputs from this supplementary assessment of distributional fairness** to complement existing CAP1616 assessment of options and their refinement (to mitigate risks of socially unacceptable outcomes)
- ✘ **Design and develop transparent communication tools**, drawing on outputs from the supplementary assessment of changes in noise distribution, to enhance the quality of community engagement over selected airspace change options. Introduce a Q Methodology approach prior to Focus Groups to gain a greater understanding for the influence of attitudes on perceptions of fairness, and support development of materials for the focus groups.
- ✘ **In consultation, present communities with viable options** (even if one is presented as preferred) and with information that enables individuals to make informed decisions about their own preferences, which need to demonstrably influence final decisions/outcomes.
- ✘ **Input of community preferences to the final selection airspace change options**, thereby demonstrating meaningful engagement in airspace modernisation processes and helping to build trust in decision making

Next stages

Implementing Fair and Equitable Airspace Design

- ✘ **Supporting airports in their CAP 1616 journey**
- ✘ **Dissemination and feedback of the findings to both the industry and communities**
- ✘ **Implementing approach across a number of airports** in their airspace modernisation programme
 - ✘ To establish the preference for different patterns of change in the distribution of aircraft noise arising from airspace modernisation options
 - ✘ To quantify the degree of change to the distribution of aircraft noise
 - ✘ To provide an additional perspective on the assessment and short listing of airspace change options
 - ✘ Enhancing community engagement by supporting the presentation of airspace change options with meaningful information that directly addresses residents' concerns
- ✘ **Our aim is to support airports** in working towards more socially acceptable airspace design options

Please contact us if you want to explore this further

What is the objective of the fairness assessment of airspace design?

OVERALL AIM

Reducing the risk of socially unacceptable outcomes,

Distributional and procedural fairness

by socially negotiated changes in the distribution of noise burden,

ICAO balanced approach

whilst optimising noise reduction through application of the ICAO balanced approach,

Procedural and informational fairness

through effective community and stakeholder engagement sharing transparent and meaningful information.

Thank you

The report is available as CAP2971 on the CAA website

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