

Towards the Determination of Acoustic Characteristics of Ventilation Plastic Ducts



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Research Significance

Performance certainty - quality delivery is assured, project costs are confirmed, risks are eliminated

Energy efficiency - accurate predictions prevent unnecessary noise control measures (e.g. silencers) keeping low system resistance, inefficiency and costs

Purge and overheating – Separate fans used for these purposes. With better understanding of acoustic performance of the plastic ducts, it is expected that purge ventilation and overheating can be dealt with general whole house ventilation

Improved design practice – guidance for designing plastic duct ventilation system will ensure optimum use of plastic duct whilst meeting specified acoustic criteria.

Future trends – better understanding of plastics duct systems and their properties will enable suitable and wider use in construction in place of galvanised steel.



At the present...

- Ventilation in the residential sector has increasingly become mechanical in the recent years resulting in the surge in use of plastic duct ventilation systems.
- It is speculated this trend could expand in the future to other application sectors.
- To date there is no information on the acoustic characteristics of plastic ducts to enable accurate prediction of duct borne noise levels.
- Lack of accurate information leads to crude estimations or calculations based on galvanised ducting data.
- Inaccurate calculations can result in over attenuated designs leading to unnecessary noise control, introducing additional cost, regenerated noise and inefficiency.
- Calculated designs resulting in under attenuated systems require costly retrospective measures.



Literature Review- preliminary...

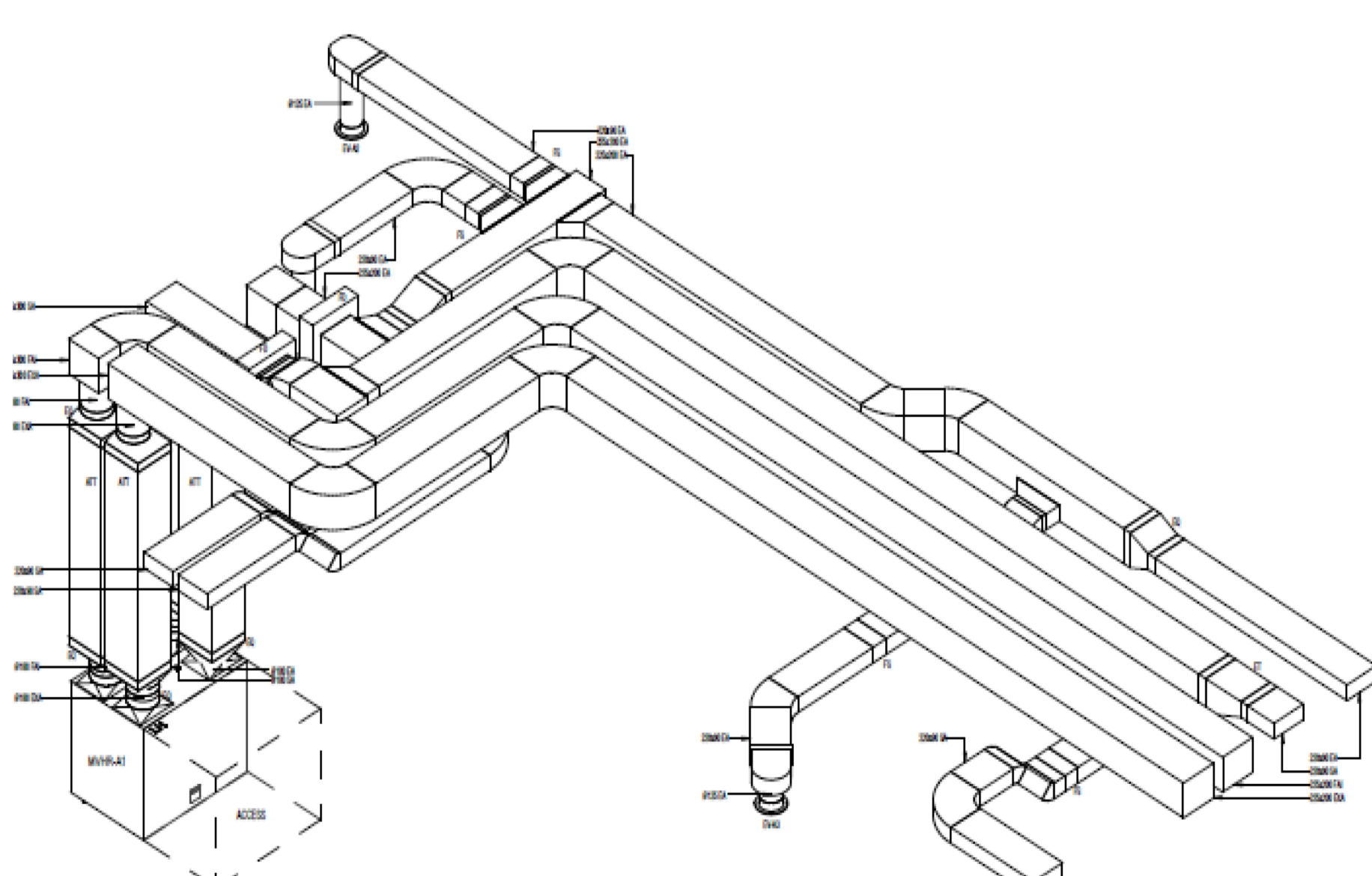
Review of test procedures shows that guidance are not well harmonised and cover only galvanised ducts and fans.

Standards used in acoustic determination of ventilation systems (BS EN ISO 11691:2009, BS EN ISO 7235:2009, BS ISO 13347-1:2004+A1:2010, BS ISO 13347-4:2004, BS EN ISO 5135:1999 and AMCA Publication 511) However these are not specific enough or well suited for the purposes of this project confirming that development of dedicated novel test methodologies might be required.

“**Noise Control in Building Services**”, A. Fry - range of different laboratory testing explained potentially applicable for this project.

“**Acoustics of Ducts and Mufflers**”, M.I Munjal – reference/guidance book on acoustics of ducts and mufflers, potentially applicable.

Measurements of “breakout” and “break-in” transmission loss of rectangular ducts. P.A. Nelson, A.T. Fry, R. Burnett – generic duct breakout/ break in testing methodology described, potentially applicable.



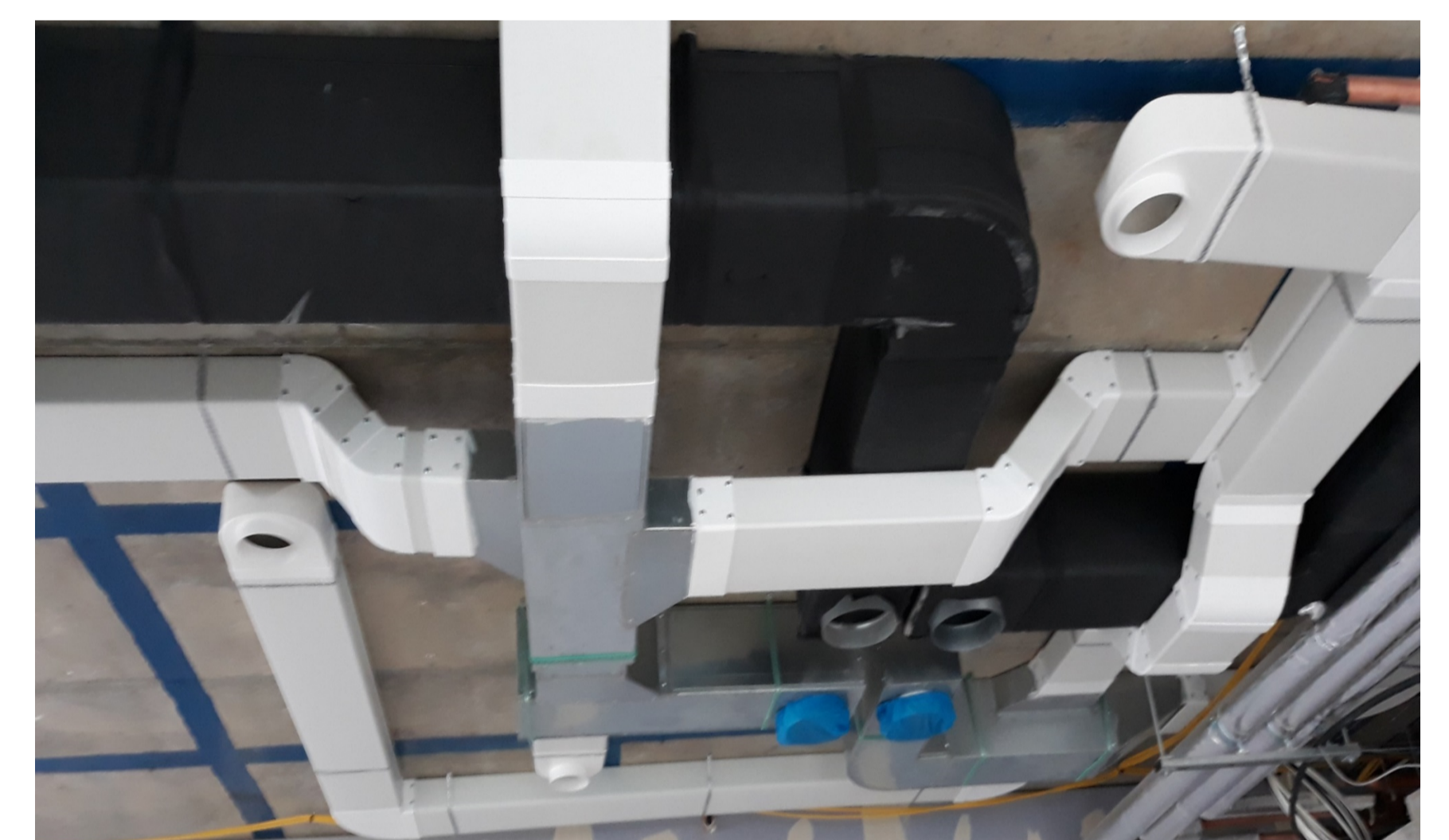
Methodology

- Review of relevant tests methods based on standards and codes of practice
- Static and dynamic methods to include regenerative noise contributions and fluid dynamic parameters
- Statistical methods for data analysis
- Parametric analytical approach to multivariable scenarios
- Development of dedicated experimental techniques for in laboratory and in situ.



Expected Results

Comparatively, it is expected that plastic ducts will show lower transmission losses than galvanised ones, but higher breakout and break-in noise levels. Other variables involved can influence initial expectations. Comprehensive testing shall confirm/verify initial expectations.



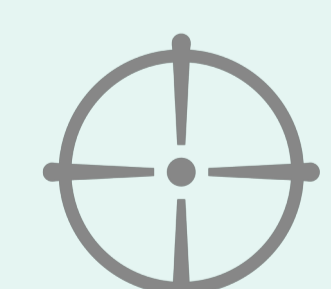
Research Aim

Determination of the acoustic characteristics of plastic ducts systems for the development of prediction models and guidance in practical installations.



Research Objectives

- Development of novel test procedures
- Design and build test rigs
- Produce measured acoustic data
- Lab and in situ data sets
- Build empirical prediction models
- Produce Acoustic Design Guidance for Plastic Duct Ventilation Systems.



Scope

- Different plastics, densities, profiles, thicknesses, junctions, configurations
- Transmission loss, breakout and break-in regenerative sound power
- Low frequency absorption
- End reflection attenuation
- Impact on fluid dynamic performance
- Temperature effect on acoustic properties.

