

Low Energy Construction, Ventilation Strategies and Indoor Radon

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1. Introduction

Low energy construction is characterized by increased thermal insulation and air tightness of the structures and by mechanical ventilation.

The study aims at exploring the effect of these factors to indoor radon concentration.

2. Methods

The study utilizes:

- Measurements of air tightness, air exchange and pressure difference in Finnish housing.
- Theoretical calculations
- ACH_{50} is the Air Exchange Rate (1/h), air flow in m^3/h per house volume m^3 , measured at 50 Pa pressure difference. A standard blower door instrumentation has been used.

3. Results

Table 1. Typical wintertime pressure differences in houses with different ventilation strategies in Pa (Pascals). Measurements in Tuusula Building Fair area in 2001.

Ventilation strategy	Typical pressure difference
Natural	1- 2 Pa
Mechanical exhaust	5-9
Mech. Supply and exhaust (nearly balanced, extra exhaust)	2-3

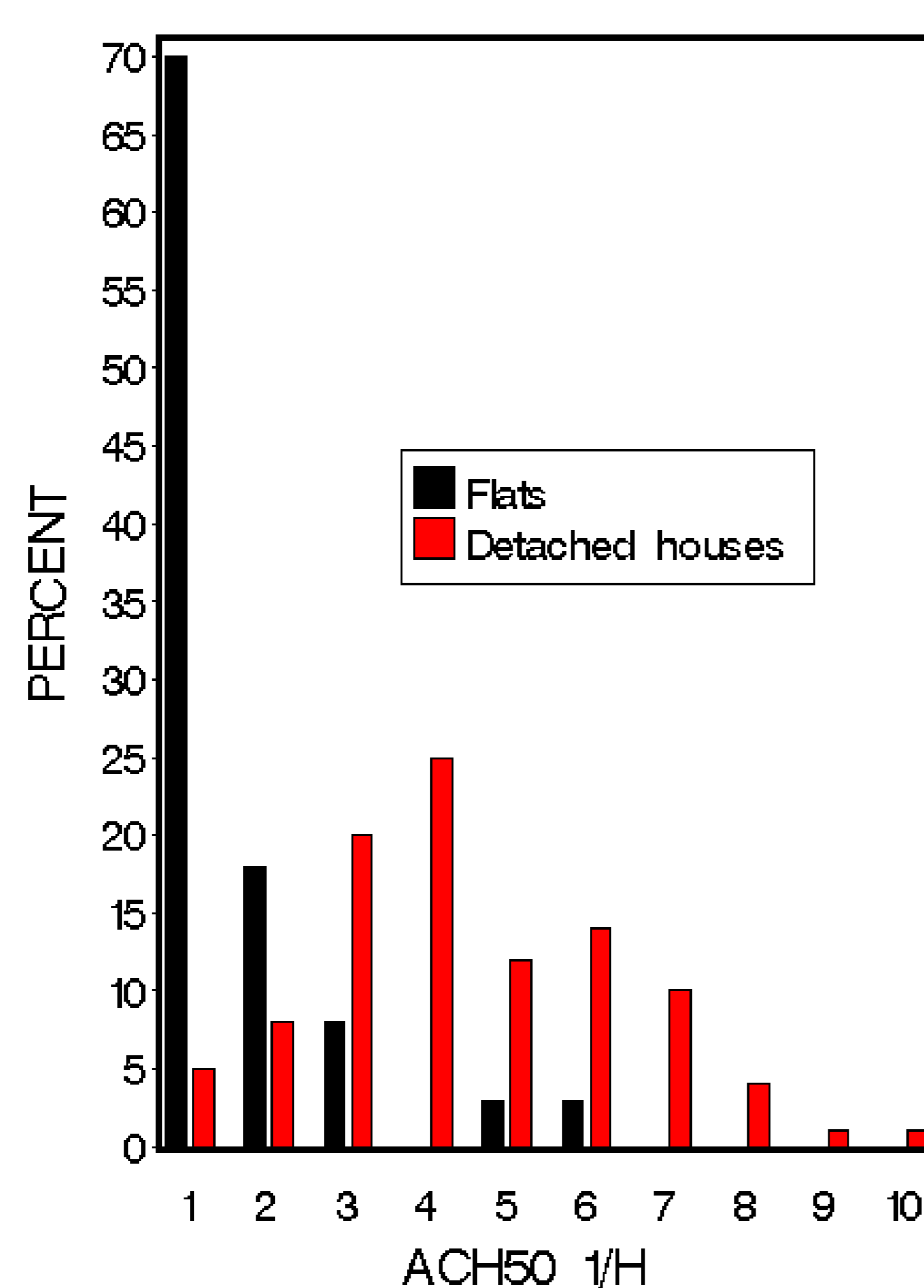


Figure 1. Measured distribution of ACH_{50} leakage factor in wooden frame detached houses and in apartments with concrete structures (Vinha et al. 2005).

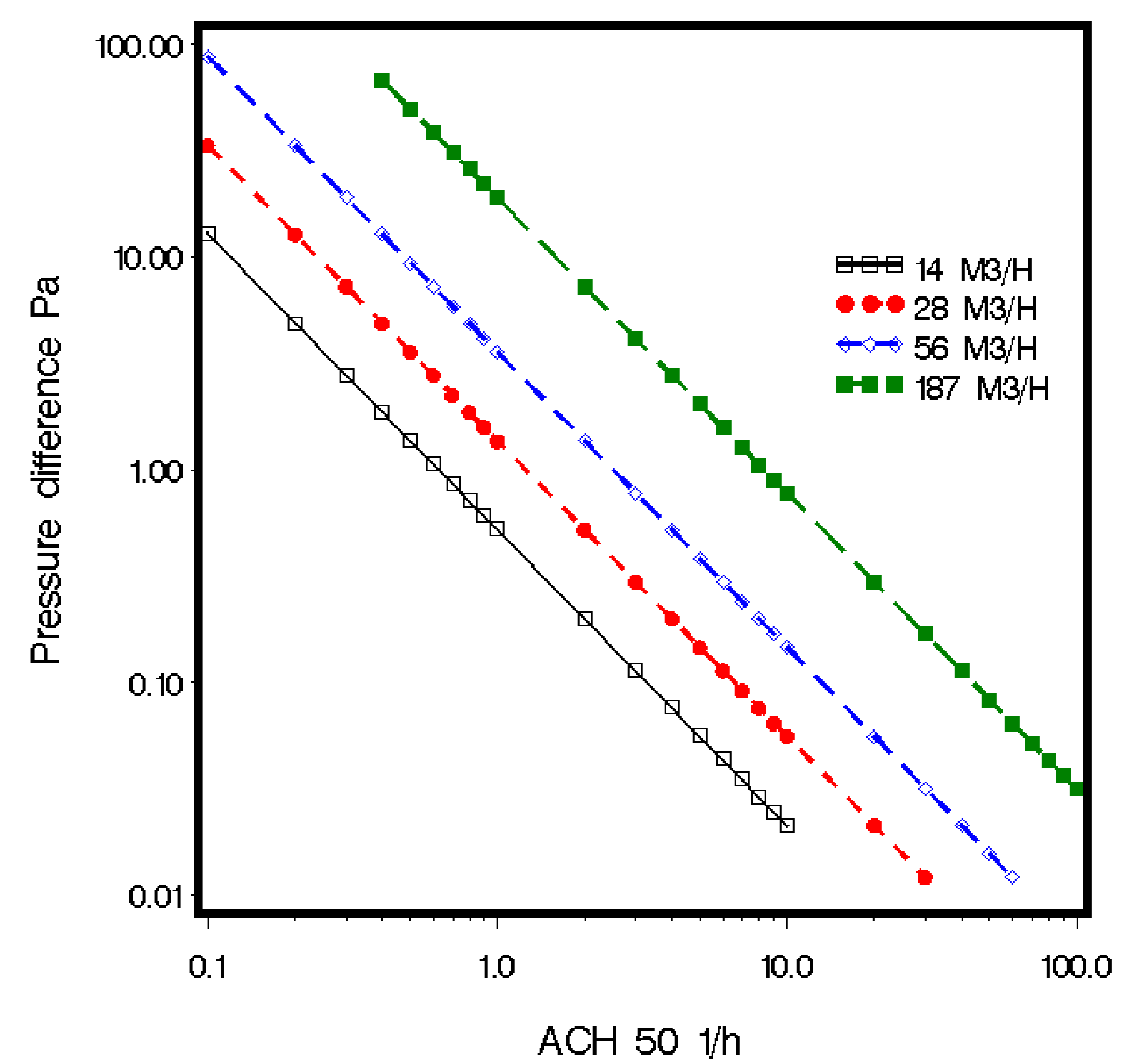


Figure 2. Pressure difference vs. air tightness. Air flows 14 -56 m^3/h represent 7.5 -30 % decreased supply air flows compared with balanced ventilation. 187 m^3/h represents exhaust ventilation, house volume of 375 m^3 .

Table 2. Effect of ventilation strategy and reduction of pressure difference in Finnish lowest floor apartments with floor slab in ground contact, STUK measurements.

Ventilation strategy	Pressure difference, typical	Radon, mean
Mechanical exhaust	8 -14 Pa	122 Bq/ m^3
Balanced	2-6 Pa	< 70 Bq/ m^3

4. Conclusions

Pressure differences created by mechanical ventilation increase radon concentrations – in the case the airtightness of the building shell is high.

High airtightness, $ACH_{50} = 0.6$ 1/h is required from passive construction. This may increase radon concentration by a factor of 1.5 although balanced ventilation is used. Lower ACH_{50} values may multiply radon concentration compared with typical ACH_{50} values 2-5 1/h.

Low-energy construction challenges to construct airtight base floors and to seal pipe penetrations.

5. References

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Vinha, J., Korpi, M., Kalamees, T., Jokisalo, J., Eskola, L., Palonen, J., Kurnitski, J., Aho, H., Salminen, M., Salminen, K. & Keto, M. Air tightness, indoor climate and energy economy of detached houses and apartments. Research Report 140. Tampere University of Technology. Department of Civil Engineering. Structural Engineering. Tampere 2009. (In Finnish, Abstract in English)