

Arkito: Architectural Form and the Stack Effect - Natural Ventilation in Housing

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Whilst there has been considerable development in relation to the natural ventilation of buildings, there has been a tendency to focus on technical solutions. There are however several aspects of natural ventilation that require a conscious architectural input in order to be successful, for example in relation to the spatial organisation of a building in both plan and section. The successful design of naturally ventilated buildings therefore requires a cross-disciplinary design approach involving architects and engineers. The aim of this Danish project is therefore to use a cross-disciplinary approach to develop prototypical naturally ventilated housing where architectural form and spatial disposition are used to promote the natural forces that drive natural ventilation. In this way it is hoped to achieve an integrated synthesis of form and function, so that the architectural quality is improved.

Theoretical and practical investigations show that natural ventilation has energy-saving and environmental advantages in comparison to both mechanical extract ventilation and mechanical ventilation with heat recovery when one also takes into account the electrical consumption to the ventilators. It has also been shown that natural ventilation can achieve a satisfactory air change rate and give a good indoor climate. However, a house's spatial disposition and the design of the ventilation openings have a critical influence on the exploitation of the natural forces that drive ventilation. The project therefore has the following phases:

Phase 1: Literature survey

A collection and analysis of existing knowledge in relevant areas. One of the aims here is to promote a cross-disciplinary understanding by analysing and presenting the architectural aspects of natural ventilation to the engineers involved in the project, and by analysing and presenting the engineering aspects of natural ventilation to the architects involved in the project.

Phase 2: Development and architectural design of prototypical houses

2.1 Architectural and engineering design of typical apartments, terraced houses and detached houses.

The design will focus on the development of architectural solutions where the housing's form and spatial

disposition in plan and section promotes natural ventilation by the stack effect.

2.2 Design of ventilation openings.

A study of the design of ventilation openings to assess comfort and indoor climatic aspects and to help the development of the prototypical housing designs. The study will especially focus on how a modified type of double facade that is suitable for housing can be developed.

With a cross-disciplinary approach to the activities, the aim is to refine the prototypical housing designs in an iterative process, so that the architectural and technological solutions are constantly improved in relation to each other.

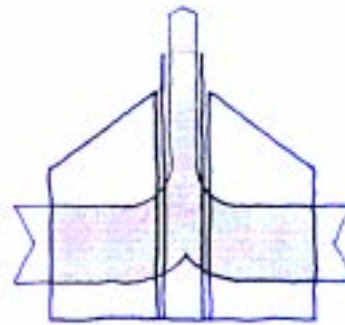


Figure 1a: The chimney used as spatial element: chimney placed centrally in the house's plan with outlet above the roof's ridge.

Phase 3: Dissemination

The project results will be widely disseminated to all actors involved in the housing and construction sectors, but with a focus on architects and engineers to promote cross-disciplinary design approaches

Project Group

The project is sponsored by the Danish Energy Agency's Energy Research Program 2000 and runs from July 2000 to June 2002. The project group consists of

Aarhus School of Architecture (Project leader: Rob Marsh Architect MAA PhD); Department of Building Technology, Aalborg University; Danish Building Research Institute; Bæk Simonsen and Aaris Architects; Birch & Krogboe Engineers; WindowMaster A/S; Viborg Housing Association.

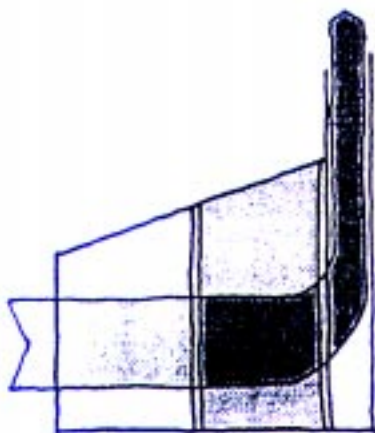


Figure 1b: The chimney used as spatial element: zoned house in plan and section with tall chimney placed along the roof's ridge.

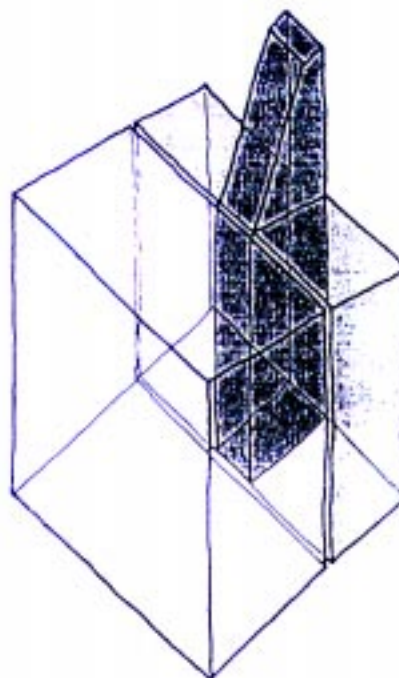


Figure 2: The chimney as a ventilation element used to spatially organise the house; vertical and without bends, and with the kitchen and bathroom located around the chimney.