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Research into air flows, heating systems and ventilation

How can the air in a room be made to move in the best possible manner as far as the occupants of the room are concerned? This is one of the problems being considered, and for which various solutions are being tried, by the Building Services Engineering Section of the Department of Heating and Ventilation at the Royal Institute of Technology in Stockholm.

Research work carried out by the Section is based on specific problems and on their technical aspects. This means that the Section is not concerned with the quality or lack of quality of air or other medical aspects. Put simply, we are concerned with distributing air without draughts and arriving at designs which ensure that the air moves through a room in the best possible manner as far as the occupants of the room are concerned. We attempt to find design arrangements which are as independent of, and unaffected by, factors such as windows, radiators, room size, the number of occupants, the position of air inlet and extraction fittings and so on as possible.

This is how Professor Tor Göran Malmström describes the work of his section. The Section forms part of the Department of Heating and Ventilation, and Professor Malmström has been with it since 1982. Together with three research workers (hopefully increased to four in the autumn) a technician and an assistant, Professor Malmström is concerned with such matters as ensuring the best possible ventilation in dwellings and working premises.

»Unfortunately, ventilation is an often-neglected aspect, dealt with towards the end of a building project», points out Professor Malmström. »When budgets have been exceeded, and developers are looking for something to cut back on in a hurry, it is often the ventilation system that suffers. And the results can be just as unfortunate,» he points out, »if, after installing a good ventilation system, it is not properly balanced and adjusted. If this is not done correctly, the whole system is more or less wasted, as it cannot be expected to operate properly without careful adjustment. But this costs money, as specially-trained personnel must spend a week or so in carrying out the work. If an attempt is made to cut back on this cost, it is highly probable that the system will not work as expected, followed inevitably by complaints about draughts and other problems.»

Computer pioneers

Considerable use is made of computers in the research work carried out by the Section. The Department of Heating and Ventilation was, in fact, one of the pioneers in the use of computers for research, starting in 1956 when computers still filled whole rooms. The computer provides unsurpassed facilities for running simulated sequences with many varied parameters in a manner which would be practically impossible in any other way. The ability to vary so many parameters is important, as there are so many factors and combinations of factors that can influence air flows.

Simulation of air flow

The department is engaged on a number of widely different research projects. One of these is the »Simulation Model for Air Flows in Ventilation Systems and Buildings», with Magnus Herrlin as project leader.

Bearing in mind the fact that air flows in buildings and ventilation systems have been a subject of research by the Department since the 1940s, it is only natural that a project of this kind should be one of the first when the Building Services Engineering Section was established a few years ago.

The model investigations forming part of the project make it possible to investigate the conditions governing functional performance interaction between the building and its systems. The project also involves simulation of ventilation system performance as far as air distribution throughout the building is concerned.

So far, the work has resulted in a review of the literature, and other aspects, and will continue during 1984 with production of a mathematical model. It is intended that this model should be suitable for such purposes as analysing the stability of ventilation systems when subjected to external effects such as wind and thermal forces. It will also be possible to investigate how heat requirements vary when outside air infiltrates into the building as a result of various weather conditions, to investigate how pollutants are transported within the building and so on.

Heating systems

Another project greatly assisted by the use of a computer is concerned with a simulation model of heating systems. The project leader is Senior Lecturer Göran Olsson, previously with the Department of Reactor Physics at the Royal Institute of Technology. This work is intended to produce a mathematical model of heat release and water flow in a radiator system so that it will be possible in the long term to say how flows and heat release vary as a result of various system designs and operating conditions. The objective is to provide a basis for the best possible choice of components and system designs, as well as to indicate the ideal system operating strategy.

During the autumn, the Department will be engaged on an outside project concerned with fire ventilation. Together with the Swedish National Testing Institute and the Norwegian Institute of Technology, the Department will be investigating the spread of smoke during hospital fires. Much work has been done concerning the spread of smoke in buildings, but much still remains to be done. The objective is to gain precious time, for every minute and second counts when occupants must be evacuated from a burning building. The spread of smoke needs to be delayed or prevented. The work will also involve checking the guidelines which at present concern system design from a fire safety viewpoint.

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