

PREDICTION OF AIR TEMPERATURES IN DIFFERENT ZONES OF A WORK HALL

C.W.J. Cox and M. Dubbeld

TNO Division of Technology for Society,
Department of Indoor Environment

P.O. Box 217, 2600 AE Delft (The Netherlands)

The air temperature in different zones in a work hall can show variations in place and time. The variations in time are due to varying outdoor conditions and to variations in internal heat production. The variations in place are due to the indoor air flows and local heat sources. For a good evaluation of the thermal stress caused by the indoor climate in such a hall, air temperatures in the zones under different conditions need to be known. One way to achieve this goal is the measurement of the actual temperatures under different conditions, but this is very time-consuming. A less time-consuming method is to predict the air temperatures with the aid of calculations.

For this purpose a multi-zone computer model has been developed. This model incorporates a dynamic heat balance equation for each zone. The heat balance equation takes account of heat exchange due to the air flow rates between the zones, of internal heat production, of dynamic heat transfer across the building fabrics, and of outdoor conditions. For each zone the air flow rates must balance. Air flow rates between zones are estimated from measurements of air velocities and the visualization of the air flow pattern in the hall. Incoming and outgoing air flow rates are estimated from measurements or calculation.

The multi-zone model can be used to predict air temperatures in different zones in a work hall under conditions differing from those during the measurements. It can also be used to predict the effect of measures to reduce thermal stress. Examples are given how the model is applied.