

THE EFFECT OF BUILDING PLANNING ASPECTS ON INDOOR AIR QUALITY

JAYASINGHE C¹ & BATAGODA J²

¹Professor, Department of Civil Engineering, University of Moratuwa, Sri Lanka

²Post Graduate Researcher, Department of Civil Engineering, University of Moratuwa, Sri Lanka

ABSTRACT

It has become common knowledge that health hazards are developing due to various outdoor pollutant sources. However, most of the people spend about 80 -90 % of their time indoors. There are a number of hazardous air pollutants such as CO, SO₂, NO₂, PM₁₀, PM_{2.5} (particulate matter), VOC (Volatile Organic Compounds) which could make an impact on human health based on different concentrations present inside buildings.

CO₂ concentration, although it is non toxic, can be a direct indication of the ventilation system of the building. Longer exposure for higher CO₂ concentration also can cause discomfort for the occupants. This paper presents a detail study on how building planning aspects can affect the indoor environment of a building. The main factors considered were the CO₂ concentration and the ventilation design of the building. Under this, area of openings (void area) of the building was considered as a measure of ventilation. Measurements were taken in residential buildings with varying openings (void) to wall ratios and openings (void) to floor area ratio of selected activity spaces. CO₂ concentration was measured and related with the ventilation design of the space in both free running and air conditioned buildings.

The other parameters considered in the study are the indoor SO₂ concentration, NO₂ concentration, temperature and relative humidity varying with relevant factors. The factors considered are the type of cooking fuel, vehicle emissions coming from the nearby roads, wind speed and dilution effects of pollutants and also the effect of micro climate on indoor thermal comfort. As the main findings the building planning aspects were found to be very important in minimizing the bad effects of pollutants, by diluting the higher pollutant concentrations by providing openings considering wind direction and orientation of the building. Area of openings in excess of what is provided in the building regulations can improve the ventilation system in a free running building. The operating practices of ventilation system have to be given equal importance as the ventilation design.

Considering cooking fuel, out of the varieties used in Sri Lanka, fire wood can produce higher SO₂, NO₂, and even higher CO₂ concentration at the start of the fire. If ventilation system of the kitchen is not operated properly, the situation can become worse with higher pollutant levels persisting for a longer duration. When the coconut husk, leaves and other plant matter is used in the cooking fire, very high SO₂ and NO₂ values were recorded. Therefore, it is proposed to avoid such material used in the fire.

Although slightly high SO₂ values were observed close to the roads, the dispersion rates are high so that indoor environments are not much affected yet. However, precautions should be taken to introduce cleaner vehicle fuel since a good outdoor air quality is essential for acceptable indoor air quality in free running buildings. It is also important to create better micro climates around the houses not only to act as a barrier to the emissions from vehicle fuel, also it helps to cool down the indoor environment by lowering the temperature by 1 to 2 °C.

KEYWORDS: Indoor Air, Ventilation, Pollutant Levels