

## Cooling Performance and Indoor Air Quality Characteristics of an Earth Air Tunnel Cooled Building

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**Abstract:** Most of the modern air-conditioned buildings have a low fresh air supply to reduce energy consumption. This results in a poor indoor air quality (IAQ) and a 30–200% higher sick building syndrome than that of a naturally ventilated building. Alternatively, energy-efficient and eco-friendly earth air tunnel system (EATS) provides a good IAQ because of the sufficient fresh air supply. This paper presents the cooling performance and IAQ characteristics of a sparsely occupied building supported with an EATS. The building was monitored for the concentration of fine and coarse particulate matter (PM), carbon dioxide (CO<sub>2</sub>) and carbon monoxide (CO), temperature distribution and relative humidity (RH) in September and October 2012. The average PM<sub>10</sub>, PM<sub>2.5</sub> and PM<sub>1</sub> concentrations were 6.77, 6.11 and 3.17  $\mu\text{g}/\text{m}^3$  respectively when the EATS was operated. These are marginally higher compared to that when the EATS was not operated. The average indoor CO<sub>2</sub> level, air temperature and RH were 418 ppm, 26.5 C and 58.2% respectively when the EATS was operated. The diurnal indoor CO<sub>2</sub> trend relates well with photosynthetic and anthropogenic activities in and around the building. The CO<sub>2</sub> and PM concentrations correlate well with indoor air temperature and RH with a time lag.

**Keywords:** Earth air tunnel system; Geothermal cooling; Indoor air quality; Passive cooling; Thermal comfort