

## INVESTIGATION OF GROUND TEMPERATURE FOR HEAT SINK APPLICATION IN KUCHING, SARAWAK, MALAYSIA

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**Abstract** - Ground Air Heat Exchanger (GAHE) may be a solution to improve thermal comfort in buildings located in Sarawak but no ground survey specifically to examine the potential of GAHE has been done. Ground temperature prediction with computer program did not provide an accurate result for this region. In this study, a few sites with different soil profile in Kuching, Sarawak were selected to determine the soil temperature up to 4 meters depth. For peat soil area with high water table, the ground mean temperature is about 28 °C after 1m depth. For sandy clay type soil which is subjected to tidal activity, the daily soil temperature fluctuates greatly with the highest maximum temperature exceeding 32°C for all depth. This behavior is not really desirable if the ground were to be used as a steady heat sink source. Red podzolic soil gave an almost flat profile between 26°C to 27°C after the depth of 1m which is more desirable as a ground heat sink source. Therefore earth tube application in the state of Sarawak should consider the type of soil profile and optimum depth of to take advantage of the cool ground to provide building cooling.

**Keywords:** Ground temperature, heat sink, Kusuda Formula, earth tube, Sarawak soil temperature

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### 1.0 INTRODUCTION

Several pertinent studies have shown that the indoor thermal condition of a single-storey as well as double-storey terrace houses in Malaysia usually will exceed the recommended thermal comfort range as reported in [1] and [2]. The peak temperature is somewhere between 30 to 35° C in the afternoon which is beyond the thermal comfort range of between 28 °C to 31 °C at air velocity of 0.8m/s for natural ventilation in this climate condition [3]. Studies have been done that showed building could be passively cooled by transferring the heat to the ground [4] - [5]. The ground will act as a heat sink source to offset the peak temperature of the building indoor air. Earth tube application such as Ground Air Heat Exchanger(GAHE) basically cools room air by forcing the ventilation air into the ground via long metal or plastic pipes before entering the building as shown by [6] and [7] in the regions of Peninsular Malaysia. However, the study conducted was site specific and no further tests were done on other types of soil profile in Malaysia and the corresponding optimum depth. No such survey and earth tube application has been implemented in Sarawak so far. Building thermal modelling software such as TRNSYS, Design Builder or Energy Plus could be used to predict vertical soil temperature profile for different categories of soil condition. However the built in Kasuda Formula in the software did not provide an accurate soil temperature profile. This will be elaborated in this paper. The objectives of this study is to obtain soil temperature up to 4m depth in different type of soil profile in Sarawak where the data could be used to accurately study the performance of earth tube technology to passively cool building.