

## Performance Analysis of Air-Tunnel Heat Exchanger Integrated into Raft Foundation

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**Abstract :** In this study, a field experiment and performance analysis of air-tunnel heat exchanger integrated with water-filled raft foundation of residential building were performed. In order to obtain better performance, conventional applications of air-tunnel inevitably have high initial cost or issues about insufficient installation space. To improve the feasibility of air tunnel heat exchanger in high-density housing, an integrated system consisting of air pipes immersed in the water-filled raft foundation was presented, taking advantage of immense amount of water and relatively stable temperature in raft foundation of building. The foundation-integrated air tunnel was applied to a residential building located in Yilan, Taiwan, and its thermal performance was measured in the field experiment. The results indicated that the cooling potential of integrated system was close to the potential of soil-based EAHE at 2 m depth or deeper. An analytical model based on thermal resistance method was validated by measurement results, and was used to carry out the dimensioning of foundation-integrated air tunnel. The discrepancies between calculated value and measured data were less than 2.7%. In addition, the return-on-investment with regard to thermal performance and economics of the application was evaluated. Because the installation for air tunnel is scheduled in the building foundation construction, the utilization of integrated system spends less construction cost compare to the conventional earth-air tunnel.

**Keywords :** air tunnel, ground heat exchanger, raft foundation, residential building

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