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ACCEPTED MANUSCRIPT

Study on thermal pressure in a sloping underground tunnel

under natural ventilation

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Highlights

- A field test at the traffic tunnel in an underground hydropower station was carried out.
- A theoretical formula of temperature decrease was theoretically derived, validated and used to calculate the thermal pressure in a sloping underground tunnel.
- A formula of thermal pressure is acquired in a sloping underground tunnel under natural ventilation.
- A simplified method is recommended to calculate the thermal pressure.

ABSTRACT: Tunnels are of key importance to the ventilation network in underground buildings. For sloping tunnels, the effect of thermal pressure on the underground ventilation system has not been clarified in the existing research. A field test in an underground sloping tunnel was carried out and the results showed that the temperature decreases in the form of exponent. Based on an exponential model of temperature decrease, an equation to predict thermal pressure is proposed for sloping underground tunnels. Four factors on the thermal pressure, surface roughness of the tunnel wall, air velocity, dimensions of the underground tunnel and temperature difference between the air and the tunnel wall are discussed in detail. Surface roughness of the tunnel wall, air velocity and dimensions of the tunnel have been found having little impact on the thermal pressure efficiency when the tunnel is beyond the length of L_{min} . The temperature difference between the air and the tunnel main factor on the thermal pressure efficiency. A simplified method is recommended to calculate the thermal pressure for sloping underground tunnels.

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