ABSTRACT

During braking, heat is generated due to frictional contact between the brake pads and the brake disc (rotor) of a vehicle. At elevated temperatures, brake fade may occur, leading to potentially catastrophic brake failure in a vehicle. The heat-dissipating characteristic of a brake disc is a function both of the physical design of the brake disc, and also the brake disc material. This research focuses on the effect of brake disc design, in particular, how the surface temperature is affected by increasing the surface area of a brake disc's ventilated channel. The surface temperature of a newly developed brake disc with a wire woven porous ventilated channel (the design of which is not part of this research) will be compared to existing commercially available designs, and the parameters governing transient thermal response for solid, ventilated, and porous brake discs during extended braking will be identified and compared.

The results of this research reveal that the thermal capacity of a brake disc determines the initial rate of brake disc temperature increase (T), resulting in initial temperatures being $T(\text{solid disc}) < T(\text{pin-finned disc}) < T(\text{WBD disc})$. However, for extended braking, the ventilated discs run at lower temperatures and reach a lower steady state temperature than the solid rotor i.e., $T(\text{solid disc}) > T(\text{pin-finned disc}) > T(\text{WBD disc})$ due to the increased convective surface area and addition of forced convection in the ventilated channels. With the WBD core, a substantially lowered disc temperature can be achieved.