

Aerodynamic Study of an Open Window Moving Bus with Passengers

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Abstract : In many countries, buses are the principal means of transport, of which a majority are naturally ventilated with open windows. The design of this ventilation has little scientific basis and to address this problem a study has been undertaken involving both experiments and numerical simulations. The flow pattern inside and around of an open window bus with passengers has been investigated in detail. A full scale three-dimensional numerical simulation has been used for a) a bus with closed windows and b) with open windows. In either simulation, the bus had 58 seated passengers. The bus dimensions used were 2500 mm wide \times 2500 mm high (exterior) \times 10500 mm long and its speed was set at 40 km/h. In both cases, the flow separates at the top front edge forming a vortex and reattaches close to the mid-length. This attached flow separates once more as it leaves the bus. However, the strength and shape of the vortices at the top front and wake region is different for both cases. The streamline pattern around the bus is also different for the two cases. For the bus with open windows, the dominant airflow inside the bus is from the rear to the front of the bus and air velocity at the face level of the passengers was found to be 1/10th of the free stream velocity. These findings are in good agreement with flow visualization experiments performed in a water channel at 10 m/s, and with smoke/tuft visualizations in a wind tunnel with a free-stream velocity of approximately 40 km/h on a 1:25 scaled Perspex model.

Keywords : air flow, moving bus, open windows, vortex, wind tunnel

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