

## **Moving ground effects on the wheelhouse flows of heavy vehicles**

David Söderblom\*, Per Elofsson\*\*, Linus Hjelm\*\*\* & Lennart Löfdahl\*

\*Chalmers University of Technology, 412 96 Göteborg, Sweden

\*\* Scania CV AB, 151 87 Södertälje, Sweden

\*\*\* Volvo 3P, 405 08 Göteborg, Sweden

In the optimization of the aerodynamic design of road going vehicles the importance of ground simulation has been a well known fact for quite a long time. A correct simulation of the boundary conditions underneath the vehicle, including rotating wheels and moving ground, is of outmost importance in minimizing the drag coefficient. For heavy vehicles there are currently no moving ground facilities available for full scale testing due to their weight and size, however, some simple scale model experiments on the aerodynamic optimization of long haulage trucks with ground simulation have been reported recently.

In the current paper a detailed investigation of the flow structures in the front wheelhouse of a typical long haulage truck has been performed. A detailed tractor-trailer geometry, including a fully detailed wheelhouse and engine compartment, has been used and focus has been put on the front wheel and wheelhouse. The flow structure in this region is extremely complex due partly to the wheel rotation and partly to the interference with the free stream flow as well as the cooling air flow. The objective of the paper was to achieve an improved understanding of the wheel and wheelhouse flow in order to be able to optimize the design from an aerodynamic perspective and by that reduce the fuel consumption of the vehicle. Computational Fluid Dynamics (CFD) methods were used, and the wheelhouse flow was investigated using different approaches for the numerical modeling of the rotating wheel, the condition for a boundary velocity on the wheel, and a model for a rotating frame of reference which contains the wheel. So far all numerical results have been verified in simple visualization experiments conducted on a detailed wheelhouse model based on a 1:4-scale tractor geometry. All experiments were performed in a closed loop wind tunnel with moving ground facilities.