

Astrid Herbst, Tomas Muld, Gunilla Efraimsson, Dan Henningson:

Gröna tåget: Frontshape and slipstream for wide body trains at higher speeds

New requirements on slipstream air speeds and head pressure pulse in the revised TSI for train speeds higher than 190 km/h are more difficult to fulfill for wide body trains and high trains. The requirements are derived from experiences from trains with UIC-profile, not representing Swedish conditions. The objective of the project is to increase the knowledge about slipstream air flow of wide body trains at high speeds, understand the implications of the new requirements on the front shape and to develop a prediction methodology in order to take this into account early in the design cycle.

For head pressure pulse a well defined prediction method exists. However, the slipstream in the wake of the train is one of the most difficult aerodynamic phenomena to predict. Analysing the flow structures in the near wake of high-speed trains and improving the prediction methodology for slipstream has been a major part of this project.

The final design of a train is an optimization balancing various requirements. The final goal is to generate a design which has a good performance both with respect to the slipstream generated behind the train and with respect to the pressure distribution around the front because the front for most modern trains can be operating as the rear as well. Improving the performance with respect to slipstream has significant impact on the aerodynamic drag. Reducing aerodynamic drag saves up to 15 percent of the energy in high speed trains. Limiting drag and maximizing stability also increase acceleration which reduces traveling time.