

AERODYNAMIC PROBLEMS OF HIGH-SPEED TRAINS RUNNING ON CONVENTIONAL TRACKS

Although the use of rudimentary aerodynamic techniques, to attempt to reduce the air resistance of trains, was made as far back as the end of the nineteenth century, it is only the advent of the modern high speed train, designed to run at 160km/h and above, that has warranted the initiation of comprehensive programmes of aerodynamic research. A characteristic of much of the early work was that it was directed, almost exclusively, towards the reduction of air resistance. It was generally concluded that the advantages of higher speeds and reduced fuel consumption were not sufficient, for the everyday case, to outweigh the penalties due to inaccessibility for maintenance, problems of overheating, and the initial cost of the streamlining fairings.

The attractiveness to the short-haul traveller of lower journey time, and the increased revenue it would bring to the railways, has provided a new incentive to improve the aerodynamic efficiency of the conventionally tracked train. The attraction of higher speeds can only go hand in hand with maintaining or improving comfort and safety levels, and also convenience and cost, but is it now recognised that an improvement in aerodynamic efficiency will contribute towards these ends.

This change of emphasis from higher maximum speed to reduced journey time has wider implications, one being the consequences of lowering train weight in increased susceptibility to overturning in cross-winds. Other important aerodynamic effects that have now been identified are connected, not just with the vehicle's own mechanical ability to reach high speeds, but with the implications that high-speed running has on the trackside environment and on the comfort of the train occupants due to pressure changes when passing through tunnels etc.

The intention of this paper, therefore, is to identify the range of aerodynamic problems associated with high-speed trains, to describe some of the work that is being done by British Rail and others, and to point out particular areas where further work ought to be done. Though much of the work is orientated specifically towards the Advanced Passenger Train, some more fundamental research is also involved, which is applicable to any streamlined high speed train configuration.