CHAPTER SEVENTEEN

High-Speed Train Cab
British Rail

17.1 INTRODUCTION

The High-Speed Train (HST) driver's cab is manufactured by British Rail Engineering Ltd (BREL) at their Litchurch Lane Works, Derby.

The complete cab consists of a shell, floor, and bulkhead together with various other fittings such as valence panels, doors, windows, desk, seats, and instrument console. The shell and bulkhead are constructed from GRP skins with polyurethane (PU) foam core, the floor consists of GRP skinned rigid PVC foam, and the other fittings are straightforward GRP laminates.

With the introduction of electrified passenger train services in the 1960s BR discovered that increasing number of passengers were choosing to travel by train in preference to using a car or the services offered by internal airlines. To exploit this trend the HST was introduced. It was necessary to develop the HST as quickly as possible in order to capitalize on the increased passenger numbers by providing faster journeys. The need for speed of implementation of the HST imposed certain constraints on the design of the vehicle.

17.2 DESIGN CONSIDERATIONS

17.2.1 Specification

Because of the necessity to produce the HST as quickly as possible the design was based on conventional technology rather than using revolutionary concepts. A study of the axle loadings and power requirements resulted in the need for two power cars, each with a single diesel engine. With this requirement, there were operating advantages in having a power car at each end of the train with the ability to control both cars from one end. With this arrangement of power cars it was possible to lay down the following specification for the cab construction within the total vehicle concept.

(a) The shape had to be aerodynamically efficient (streamlined) to reduce the effect of shock wave in front of the train when passing other trains and when entering a tunnel or station.
High-speed train cab

(b) The structure had to be as light as possible for economic power consumption. In addition, low-weight trains mean less track maintenance, especially high-speed trains.
(c) The method of manufacture had to be suitable for a production run of 100-159 units.
(d) The structure had to protect the driver from missiles thrown or suspended from bridges by vandals. With trains travelling at 200 kmh (125 mph) this is a serious problem for designers and was the most important consideration in the choice of cab construction.

17.2.2 Streamlined shape

To gain an indication of the most suitable aerodynamic shape for the cab a number of full-scale trials were undertaken using a mock-up cab fitted to the front of a conventional electric locomotive. The experimental cab was constructed from single-skin GRP and its nose angle, when fitted to the locomotive, made adjustable. Pressure sensing equipment was installed in the locomotive to record the optimum cab position under a variety of operating conditions; tests indicated that an angle of 40° to the vertical was the most satisfactory.

In the production cab some of the design features adopted for the prototype were considered because of operator preferences which were made clear from the results of evaluation trials. For instance, the seating positions of driver and secondman were altered from a staggered position in the prototype to a side-by-side arrangement in the final production model. The reasons for specifying staggered seating positions in the prototype - with driver seated in front of secondman - was to afford the driver a clear view of the track and control console and to simplify his driving technique. Additional side windows in the cab were also requested by the test drivers. These factors contributed to a change in the overall shape of the production cab since to accommodate the required seating positions, whilst preserving the driver's line of sight, necessitated the provision of a larger windscreen. This, together with the additional side windows, increased the solar heat input to such an extent that air conditioning in the cab was essential. To accommodate this requirement and provide for the electrical equipment displaced by the different seating arrangements resulted in an extended nose cone. This also permitted relocation of the horns from the cab roof where installation problems had been experienced. As a further modification to the cab's appearance the two external buffers were removed, being replaced with simple valence panels. Access to the coupling gear was by removal of the central valence panel. Thus, the production cab had a more pointed nose cone that the prototype, being now approximately 50° to the vertical.

17.2.3 Weight saving

The GRP/PU foam cab, excluding floor and bulkhead, weighs approximately 630 kg which represents a predicted weight saving of 220 kg (35%) over a comparable steel structure.