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**Secretariat memorandum**

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Agenda item 7

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**Bus staircase design**

**1 Purpose of report**

- 1.1 To review the history of bus staircase design, with a view to making representations to Transport for London (TfL) in the context of its consideration of future bus designs.

**2 Information**

2.1 Introduction

- 2.1.1 At the Transport Accessibility Committee meeting on 29 October 2008, there was a brief discussion of bus staircase design, in the context of the Mayor's competition to design a new double-deck bus for London. The issue was the suitability of the straight staircase, which has been standard on London buses since about 2000.

2.2 History of bus staircase design

- 2.2.1 The traditional London (and British) double deck bus design was established in the 1920s. It had the engine alongside the driver at the front, and an open platform entrance/exit at the back. The staircase was in the rear offside corner, turning through 90° (Fig 1). It included a curved section where the stair treads were narrower on the inside than on the outside, but the overall design of the staircase – at least in its final incarnation on the Routemaster – was such that this feature did not seem to cause much difficulty to most passengers who were capable of climbing this steep narrow staircase at all.
- 2.2.2 In the mid 1950s bus design underwent a revolution when the industry saw advantage in placing the entrance at the front alongside the driver, the staircase immediately behind the driver and the engine banished to the rear. This enabled one-person operation, but for a variety of reasons London largely resisted this trend and continued building Routemasters until the late 1960s.

One reason for London's resistance to the new layout was that, with the staircase at the extreme front of the bus immediately behind the driver, it had to ascend to the rear. This – rightly – was regarded as an unacceptable safety risk.

The reason for this was that, of the various hazards which might cause an accident on a bus staircase, a sharp brake application is one of the most serious. As a bus moves forward, so does the passenger. When the bus brakes, the passenger (unless holding on very firmly) does not slow immediately and – whether climbing or going down the stairs – is at risk of being thrown forward. On a rear ascending staircase, a passenger who is thrown forward will go into an open void and risk serious injury. For this reason, apart from on a very few experimental vehicles, London Buses and its predecessors has always insisted that staircases should ascend forward.

Fig 1 : Routemaster staircase



Fig 2 : DMS staircase





Despite London Transport having many reservations, economic and political forces drove it to adopt the new layout from 1970, on a bus known as the DMS or Fleetline (Fig 2). As well as the front entrance, there was a centre exit. This enabled the staircase to be placed near the centre of the bus, with its foot opposite the exit door. It was designed as a spiral turning through 180°, and its central position meant that it could be forward ascending and avoid the safety hazard of the rear ascending design.

Compared with the Routemaster, the spiral effect of stair treads being narrower on the inside seemed more severe, and it could be seen that if this feature of the DMS could be designed out it would be easier for passengers.

2.2.3 The 1980s saw London standardise on two double-deck bus designs – the Titan and the Metrobus. The Titan (fig. 3) was very similar to the DMS, although the spiral effect was (if anything) worse towards the bottom of the staircase.

Like the Routemaster and the DMS, both the Titan and the Metrobus – although also sold elsewhere - were specifically designed for the London market. But from the late 1980s London bought standard “provincial” buses, most of which had spiral staircases. The Metrobus, however, was different (Fig. 4).

The spiral effect was eliminated by squaring off the turns. The price for doing this was that the bottom step protruded into the gangway area of the lower saloon, reducing the width of the route from the entrance at the front to the seats at the back. In practice this was not a problem, because there were no seats opposite the staircase as this was deliberately aligned with the exit doors.

2.2.4 The late 1990s saw the advent of the low floor double-decker, with all the early examples being built for London service. The low floor bus provided a low step up from the kerb and a flat floor on the lower deck from the front entrance almost to the back. Combined with a large (but rarely thus used) wheelchair space, this transformed the use made of buses, because it now became easy to travel with baby-buggies, large shopping trolleys and wheeled luggage.

Early designs offered many different detailed arrangements for staircase, wheelchair and exit door positions and (prompted by London Buses) some had a new design of staircase – the straight staircase (although this was not actually new, as it had been tried in London in the 1930s and soon abandoned) (Fig 5).

After demonstrating various designs to user representatives, including what is now London TravelWatch – London Buses soon issued a standard specification for staircase, wheelchair and exit door positions. This included a requirement for a straight staircase. Almost all London double-deckers now have straight staircases, the only exceptions being the heritage Routemasters on routes 9 and 15 and possibly a handful of early low floor buses which have not yet been cascaded to non-London operators.

There was little doubt that for people who use the upper deck of a bus (i.e. those with no serious mobility impairment) a straight staircase was easy to climb and – when demonstrated on a stationary vehicle – easy to descend. However they have not been universally adopted, as many non-London operators still specify the spiral design; one reason for this is probably that the spiral occupies less space and therefore allows more seats.

Fig 3 : Titan staircase





Fig 4 : Metrobus staircase



Fig 5 : Straight staircase



- 2.2.5 For the passenger, the problem with a straight staircase becomes apparent once the bus actually moves. The reality is that a bus lurches about – back and fore, sideways, up and down and in any combination of these – and can brake suddenly. For passengers going up the stairs there is no real problem; if they are thrown off balance the worst that is likely to happen is that they fall forward onto the staircase. This is unpleasant and may result in minor injury, but it is a risk which passengers seem willing to take.

Descending a straight staircase is different. When standing at the top, the passenger looks down on a long open space which offers an unbroken fall if the bus lurches or brakes suddenly. Even for the most able bodied, this is psychologically disturbing, causes most users to hesitate as they descend (thus slowing the unloading of the bus) and is particularly difficult for those who are carrying bags and therefore have only one hand free to hold the handrail.

### 2.3 *London TravelWatch's position*

The issue was raised by the London Transport Users Committee (now London TravelWatch) at TfL's Bus Design Forum (now the Surface Transport Design Forum). TfL responded by encouraging bus operators to provide additional handrails on new buses. Various handrail designs were tried and offered some improvement, but did not totally solve the problem. None offered sufficient value to justify retro-fitting to older vehicles.

### 2.4 *The way forward*

The Mayor's competition to design a new double-deck bus for London provides an opportunity to revisit all bus design issues, including the staircase.

Of the various designs to date, it appears that the square staircase as used on the London Metrobus of the 1980s offers the best solution. It is easy to climb, and the absence of both the long open drop and the narrowed treads at the inner side of a spiral makes it the least difficult to descend.

It may be that new thinking could produce a fresh alternative, and that other considerations (such as new entrance, exit and engine positions) might affect the design (and number) of staircases. London TravelWatch therefore needs a policy which allows designers scope to innovate.

## **3 Equalities and inclusion implications**

- 3.1 On modern double deck buses, seating and standing space on the lower deck is severely limited by the need to incorporate other features (notably wheelchair/buggy space) and the distance which the wheel arches protrude through the floor. It is therefore important that as many passengers as possible should be able to access the upper deck with ease and in safety. The design of the staircase is critical to this.

## **4 Legal powers**

- 4.1 Section 248 of the Greater London Authority Act 1999 places upon London TravelWatch (as the London Transport Users Committee) a duty to consider - and where it appears to the Committee to be desirable, to make recommendations with respect to - any matter



affecting the functions of the Greater London Authority or Transport for London which relate to transport (other than of freight).

## **5 Financial implications**

5.1 This report has no specific financial implications for London TravelWatch.

## **6 Recommendations**

6.1 That London TravelWatch adopts the following policy on bus staircases (subject to any further evidence becoming available from practical trials) :

- (a) All staircases should be forward ascending.
- (b) Straight staircases which present descending passengers with a long drop into an open void are not acceptable.
- (c) Of previous staircase designs in London –
  - The square staircase used on the Metrobus is the preferred option.
  - The 90° curve used on the Routemaster may be acceptable, subject to careful attention to design detail and to user testing.
  - The 180° spiral used on the DMS and the Titan is not acceptable.
- (d) If an entirely new design which embodies the safety principles implied by the foregoing is envisaged, then this can be considered. However it should only be adopted after service trials on a prototype vehicle, with success being evaluated both through passenger questionnaires and by study of CCTV images of actual passenger behaviour.