



Weight watchers on tour

Tasked with stripping weight out of buses and coaches to improve fuel efficiency and cut costs, manufacturers are coming up with engineering innovations. Steve Banner investigates

British bus operators have for some time been insisting that manufacturers cut the weight of their vehicles to make them more fuel efficient. The implication has been that those who put their product ranges on a strict diet will be rewarded, while those who cannot, or will not, engage in the fight on flab will lose out.

This implicit threat has been fulfilled by First – long a keen advocate of weight reduction – in its most recent round of orders. The bus operator has moved away from heavy-duty, 18-tonne single-deckers, in favour of vehicles that tip the scales at below 14 tonnes. Its choice: 179 StreetLites, from Wrightbus; 142 Enviro 300s and 36 Enviro 200s, from ADL; and 18 Versas, from Optare. The loser in this case was Volvo, First's main supplier of single-deckers for several years. It is delivering a modest 35 Wrightbus-bodied B7RLEs – First is still ordering some heavier single-deckers – plus a pair of 7900 hybrids.

ADL chief executive Colin Robertson is understandably delighted and quick to highlight the reason he believes this prestigious order came ADL's way. "The Enviro 300 is achieving 9–10mpg, providing

significant whole-life fuel savings," he observes.

But cutting a bus's weight involves close attention to detail, if durability is not to be compromised. That means addressing everything including the shape, not just the weight, of components. As Optare deputy chief executive Glenn Saint asserts, lighter-gauge body panels can be employed, if they are pressed and shaped carefully. "Put a curve into a panel and you make it stronger, which, in turn, means you can make it thinner," he observes.

Curved glass

The same goes for glass. Volvo Bus's UK product planning manager Adrian Wickens agrees: "The swing towards bonded glass has certainly helped cut weight," he says. As it happens, the Optare Versa-derived MetroCity displayed at last November's Euro Bus Expo, at the NEC, has flat side windows, but this 10.6m model nonetheless weighs a modest 7.37 tonnes. That is despite the fact that it can carry 60 passengers, including standees.

Pressure can also be brought to bear on component suppliers to cut the kilos. "Double seats for buses were at one stage weighing at least 20kg, but manufacturers have got them down to

14 tonnes

or below, the choice of First, now moving away from 18-tonne single-deckers



closer to 15kg,” observes Saint. Polish seat maker Ster has cut that figure to 13.5kg. And lightening the seats on a double-decker’s upper deck also makes it easier for the vehicle to pass the tilt test.

However, cutting weight often involves a more intelligent approach to design, too. Seat manufacturer Cogent, for example, uses FEA (finite element analysis) software when designing its seats and has consciously avoided merely substituting aluminium for steel. “Because aluminium is one-third the strength of steel, you end up having to use more of it. So the weight saving you get may not be as great as you first anticipated,” observes chief executive Roger Pownall.

Perverse additions

And all of this has to be set against the conflicting requirements of both passengers and regulators, who seem intent on piling on the pounds as fast as chassis makers and body builders trim them away. Most new coaches are equipped with air-conditioning, double-glazed side windows and onboard entertainment systems that typically involve the installation of two or three overhead monitors.

“TfL [Transport for London] expects buses in the capital to be equipped with cab air-conditioning,” observes Wickens. They also have to be fitted with powered wheelchair access ramps, and Ster points out that the specifications laid down by TfL mean that its 13.5kg seat has to slide up to 14.5kg.

And then there’s the arrival of Euro 6 in January 2014, which could add 100–250kg to the unladen weight of a vehicle. One response has been to downsize the engines. Move from a 9.0-litre at Euro 5 to a 5.0-litre at Euro 6, as Volvo is doing with its

B5TL double-decker, and you can achieve a saving of 200–300kg, explains Wickens.

Downsizing should be pursued with some caution, however, according to Bill Simpson, ADL’s group corporate affairs director.

“Remember that a bus can be called on to operate for 14 hours a day, seven days a week,” he comments. “It may cover 250,000

miles in the first five years of its life and be required to work for another eight years or more after that.” So the question is: how capable will a smaller engine be of standing up to such a hammering? That said, put a bus on a diet and one clear benefit is that it can carry more passengers for less money. “Because of the weight we took out of it, the three-axle Enviro 500 double-decker we export to Hong Kong can handle 130, including standees,” says Simpson.

Either way, looking at materials, vehicle bodies do not have to be made predominantly from steel – special steels, such as Hardox, cut weight but come at a price – or even aluminium. With a foam core, the high-strength glass-reinforced polyester sandwich panels used by Plastisol to construct Optare’s Bonito 17-seater wheelchair-accessible minibus (Transport Engineer, April 2013, page 45) are 15% lighter than alloy and 30% less than stainless.

However, they make it almost twice as expensive as an equivalent vehicle based on a volume-built integral panel van with a steel body. Proponents make the point that these panels can be recycled. “So can aluminium and steel, but carbon fibre can be more of a struggle and there is also the question of ease of repair to be borne in mind,” warns Wickens.

Taking a different tack, though, one way bus fleets have managed to cut fuel consumption is through diesel-electric hybrid engines. Working with BAE Systems, ADL’s latest initiative in this area is ‘Arrive-and-Go’. This shuts down the engine at below 4mph, leaving the vehicle to rely on battery power. Then it re-starts the engine once the driver exceeds 7mph.

The new system is said to cut fuel usage by 6% over and above the 30–35% achieved by hybrids alone. The next step will be to extend reliance on battery power to 70% of operational bus time – a move ADL dubs ‘Virtual Electric’ – by upgrading the vehicle’s battery technology. “We should have that available in about a year’s time,” insists Simpson.

Other technologies can be adopted, including flywheel-based KERS (kinetic energy recovery system). Bus makers pursuing this route include Optare and Wrightbus – the latter hoping to have a system available in its StreetLite next year.

Meanwhile, Williams Hybrid Power has been developing a KERS for buses for some time and estimates that the fuel saving could be 15–25%.

But conventional automatic transmissions on buses are bringing fuel savings, too. Voith, for example, contends that its DIWA.6 four-speed box is up to 5% more fuel-efficient than its predecessor, thanks in large part to changes in the operating pressure. Other developments include a lighter planetary carrier, with an eye to offsetting some of the Euro 6 weight burden. **TE**

13.5kg

down from up to 25kg at one stage for the weight of double seats for buses

5 litres

the new engine size at Euro 6, down from 9 litres at Euro 5