Wind and WEIGHT

When it comes to aerodynamics, versus truck weight and profile, choosing the right fuel-saving interventions can be complicated. Ian Norwell reports

In an admirable display of solidarity, two major competitors in the trailer market put aside their differences and ran a joint presentation on body-based, fuel-saving interventions. Lionel Curtis (main picture), technical director for the Cartwright Group, joined Richard Owens, marketing manager from Don-Bur and launched into one of the most entertaining presentations of this year's IRTE Conference.

It needed to be: formulae and equations abounded. Stephen Hawking was told by his publisher that every additional equation he allowed in his book would halve the readership. However, delegates did not sneak out as the physics of truck aerodynamics, profile and weight were examined. Suffice to say, aerodynamic drag rises with the square of velocity, but there's a balancing act to be had.

Weight and aerodynamics are well known as key influencers of fuel economy, but where the emphasis lies depends on the application. Further, it may not be obvious. Owens referred to these two parameters as two sides of the same coin. His point: aerodynamics interventions on today's trucks are increasingly sophisticated, but often a trade-off with vehicle weight on the one hand and damage risk on the other.

"The boat tail is a good example," stated Owens. "It's proved that it can cut drag and fuel bills, and there's a derogation in place to enable fitment now." So, with a 7–10% potential fuel gain on offer, why aren't hauliers queueing up for it? In simple terms, he said, there's yet to be a design that doesn't have that Heath Robinson look about it, is practical to use at the rear of a trailer, and isn't prone to expensive damage.

Turning to the forces at work, Curtis said that, sitting in a modern truck moving at a constant 56mph, fleet engineers could be forgiven for thinking that all was calm and serene. "But, assuming no headwind, that 56mph breeze is in fact a Force 10 storm on the Beaufort scale. And the formal description for that describes wind speeds seldom experienced inland. 'Trees are broken off or uprooted; structural damage is likely'."

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FACTS

- Boat tails offer 7–10% fuel gain, but can be subject to damage
- Aluminium can deliver 350kg payload saving on a dry box body

MAJOR HEADWINDS

Clearly, we're talking about trucks experiencing major forces, so anything we can do to reduce drag is going to cut fuel consumption. Indeed, a 10% fuel saving between a 'naked' tractor and one fitted with even simple roof and side deflectors is an accepted figure in the industry. So what are the options?

As the price of fuel has risen, it's generally true that aerodynamic aids haven't done the same, which is good news. Owens and Curtis are trailer men, but it's obvious that tractors need to not only be slippery in terms of skin drag – Scania's latest cabs have pushed the flush-fitting ethos even further – but also require collars and spoilers that make flowing air move only once, as if around a single object.

The most obvious first obstacle to this is the gap between tractor and trailer. But it's articulated, so there's the rub. In fact, Owens and Curtis stated that this 'canyon' of turbulence accounts for almost

FACT

56mph headwind equals a Force 10 storm on the Beaufort scale

a quarter of aerodynamic drag on any tractor-trailer combination. However, this space is critical: the 2,040mm swing clearance forms a crucial part of the Construction and Use regulations.

So a dome on the headboard, as well as driver training to couple as close as possible, offers significant potential, they said. A more advanced version of the fixed dome is Don-Bur's Aeris system. An extending air bridge that deploys at higher speeds (automatically retracting to enable manoeuvrability), it is claimed to save up to 5% in fuel by effectively filling the gap between the tractor air management and trailer front bulkhead. Other options are regularly in evidence up and down the motorways. Side skirts are also effective, but prone to damage, while 'fastback' and 'teardrop' trailer shapes are probably delivering best returns.

Meanwhile, when it comes to rigid chassis on multi-drop distribution, the gains from aerodynamic aids are generally reduced, although still not to be sniffed at. Each duty cycle and operation needs to be examined to establish where gains can be had. A general rule of thumb, though, would be aerodynamics and tyres (low rolling resistance) will bring home the bacon on trunking tractors, while urban distribution rigids benefit from attention to inertial resistance, momentum and weight.

WORTH THE WEIGHT

But it's not all about drag. The next issue raised by Owens and Curtis concerned tare weight , another obvious route to improving fuel economy – or is it? Well, if you use lightweighting to gross out, you don't affect fuel economy, but you do lift productivity. So, either way, it's worth looking at the impact of chiselling away at your body superstructure.

Our two trailer men observed that there are plenty of opportunities for stripping weight out of trunking curtainside tri-axle trailers. Chassis cutouts, and aluminium side raves, cross-bearers, floors and wheels offer good starting points. But you'll struggle to make as much as a 4% dent in the 44,000kg plated weight – so 1,760kg. And there's a cost implication, too. It's a complex calculation to work out if fuel saved (or extra freight moved) will win you back what you've spent.

But going down the vehicle weight range changes this picture. Dropping down to a lightweight Mercedes long-wheelbase Sprinter at five tonnes, for example, the impact of a little creativity with materials and structures generates proportionally much more. Owens and Curtis demonstrated that such a chassis with a dry box body and aluminium tail-lift, could limbo down to 3,260kg, leaving a payload of 1,740kg.

Yes, those materials and designs will be more expensive, too, but at a 350kg payload saving, that's a 7% boost. Take it in productivity and you'll still have to get your fag packet out, but plainly the benefit will be bigger. If you are already cubing out, the gain will be easier to measure as a straight fuel win because of the lower gvw. There will also be spin-off advantages in reduced tyre wear. The cube-out or gross-out factor is important here, but the advantages of weight loss do improve with reducing gvw.

So, in summary, the case from Owens and Curtis is that trunking operations should look to improving aerodynamics and increasing cube, while urban and multi-drop fleets should focus on tare weight. Both benefit from driver training, but in stop-start operations, drivers who can intelligently use momentum and avoid becoming 'rush-and-waiters' will be the winners. ■