Freight Best Practice

Smoothing the Flow at TNT Express & Somerfield using Truck Aerodynamic Styling

Case Study

Company: TNT Express

Location: Atherstone

Fleet Size: 380 Tractor units

Company: Somerfield

Location: St Helens

Fleet Size: 698 Tractor Units

Department for Transport

Smoothing the flow at TNT Express and Somerfield

Aerodynamic drag is created as air resists the movement of a vehicle. This drag can have a significant impact on the vehicle's fuel consumption. The greater the drag, the harder the vehicle engine has to work and, as a result, more fuel is consumed.

Aerodynamic drag is affected by a number of factors, including vehicle shape, size of the vehicle's frontal area and travelling speed. Well maintained aerodynamic styling and correctly adjusted aerodynamic equipment can help to reduce drag.

Many trucks are supplied with aerodynamic styling by the manufacturer. Aerodynamic equipment can also be retrofitted to vehicles to improve fuel efficiency.

Figure 1 below shows some of the styling which can be applied to an articulated vehicle to improve aerodynamic performance.

Figure 1: Examples of truck aerodynamic styling

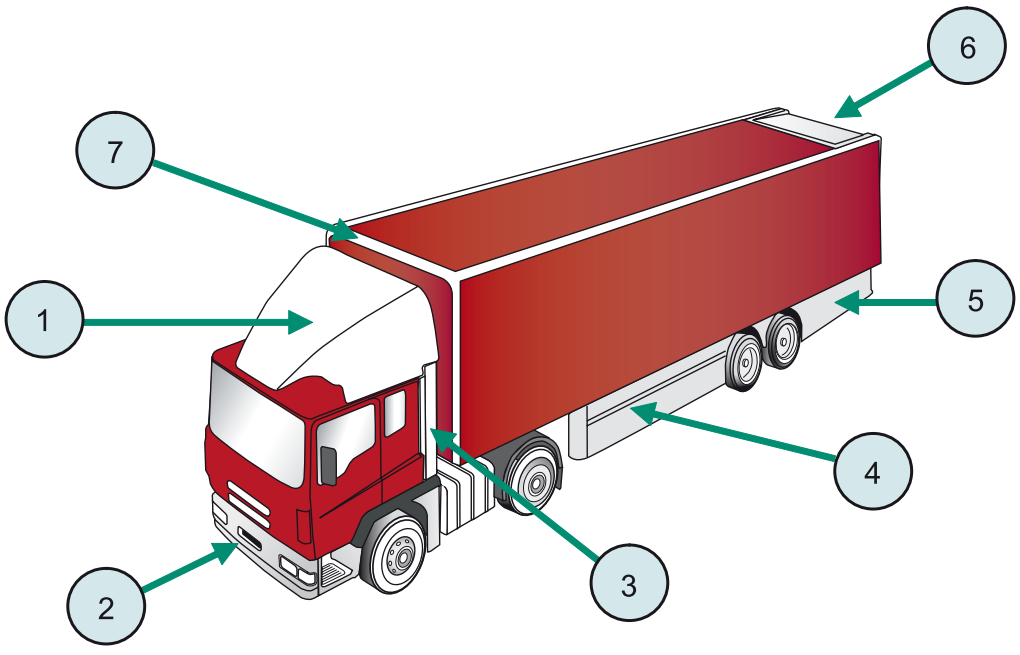
Additional non-fuel related benefits of aerodynamic styling:

- Improved stability by reducing sensitivity to side winds
- Reduced build-up of road film and dirt
- Reduced spray
- Improved vehicle appearance

Key to Figure 1

1	Cab roof deflector
2	Air dam
3	Cab extension
4	Side skirts
5	Rear quarter panel
6	Roof tapering
7	Trailer front faring

TNT Express and Somerfield have both recognised the financial benefits of improving the aerodynamic performance of truck fleets. Read on to discover how they have improved vehicle performance and saved money.



Case Study 1 - TNT Express

TNT Express provides nationwide, door-to-door, on-demand, next working day express delivery services for documents, parcels and other small freight items.

TNT 4 axel articulated box

TNT is continually investigating ways to improve the fuel efficiency of its truck fleet and decided to investigate the potential impact of aerodynamic styling on vehicle fuel consumption.

Two 32-tonne tractor units, coupled with 13.3 m semi-trailers operating on parcel trunking routes were fitted with aerodynamic styling equipment and trialled for a ten month period. Their performance was measured against non-aerodynamically styled vehicles. The aerodynamic features included:

- A three-dimensional cab roof fairing
- Cab extension panels and mudguard panels
- Side skirts
- Air dam on tractor unit
- Semi-trailer front fairing
- Curved edge on trailer roof
- Rear quarter panel

Two trunk routes were used: the first was a 320 km route from Thetford (Norfolk) to Atherstone (Warwickshire), involving limited motorway mileage. The second was a 210 km route from Durham to Atherstone, which was almost entirely travelled on motorways. On-board data loggers were used to provide information on fuel consumption, average speed and distribution of engine speeds.

Vehicle Route	Thetford - Atherstone Aerodynamics	Thetford - Atherstone Non - Styled
No . of journeys	49	49
Average Speed km/h	69.4	69.1
Mean fuel consumption km/litre	3.24	2.71
Fuel saving	**16%**	-

Vehicle Route	Durham - Atherstone Aerodynamics	Durham - Atherstone Non - Styled
No . of journeys	77	77
Average Speed km/h	79.4	79
Mean fuel consumption km/litre	3.20	2.70
Fuel saving	**15%**	-

Table 1: Results for parcel trucking trial

Potential savings

Using the average figures of **2.8 km per litre** fuel consumption and **193,080 km** travelled per TNT vehicle, total fuel used averaged **68,957 litres per year per** vehicle at a cost of **£55,166** (80p per litre). The average fuel saving of **15.8%** means that the annual savings per vehicle would be **10,895 litres** or **£8,716**. The CO_2 savings are **29,199 kg per year** per vehicle.

Drivers of the aerodynamically styled vehicles reported improved performance, especially in head-on wind conditions, and a smoother ride compared to the vehicles without the aerodynamic features.

Almost all TNT Express semi-trailers operate at the same height, so a fixed cab roof deflector can be used. With some tractors moving up to five different (but identical height) trailers a day, having fixed cab roof deflectors avoids the need for drivers to have to adjust equipment settings.

Although the potential benefits from aerodynamic styling are likely to be greatest for larger vehicles travelling longer distances at fairly constant speeds, TNT also specifies aerodynamics on its urban 7.5-tonne vehicles. The aim is to achieve optimum fuel performance on stem journeys, from the depot to the first point of delivery and on return to base. In order to avoid potentially costly vehicle damage in the urban delivery environment, the company does not fit side skirts or rear quarter panels.

In the TNT trial it was found that 85% of the fuel savings recorded during the trial could be attributed to the cab roof deflector. This means that even for operators who do not run their own trailers, having aerodynamic styling on the tractor unit can achieve considerable fuel savings.

Case Study 2 - Somerfield

Somerfield, the high street food retailer, has over 1,000 stores in the UK. Its fleet consists of 698 tractor units and 1,450 single deck semi-trailers, of which 60% are ambient and 40% are temperature-controlled, plus 28 double-deck ambient and temperature-controlled semi-trailers.

Every tractor unit within the fleet is specified with full cab aerodynamic kit, including cab roof deflector and cab extension panels (sometimes known as side ears or collars). Somerfield has been using tractor roof deflectors for over a decade and specifies them as standard on all new tractor units and rigid vehicles. Somerfield considers the roof deflectors as having the greatest fuel saving impact of all the aerodynamic kit fitted.

Introduction of double-deck trailers

In 2003, Somerfield introduced double-deck semi- trailers for trunk haul distribution from the National Distribution Centre (NDC) in Wellingborough to 14 Regional Distribution Centres (RDCs) throughout the UK. Fifteen cages can be stacked on the trailer floor, with 30 cages on the movable floor above. The financial benefits of using the new step frame double-deck semi-trailers were clear, however, fuel efficiency declined due to the increase in cab/semi-trailer height differential.

”The tractor units pulling the standard trailers had been achieving 3.4 km per litre on average, whereas when the double-deck trailers were introduced, this went down to an average of 2.8 km per litre on all the UK trunk trips.”

David Batty, National Fleet Engineer, Somerfield

"The fleet does 56 million miles per annum, equating to **£19.25 million** spent on fuel. Every 1% saved on fuel is equal to **£200,000.**"
David Batty, National Fleet Engineer, Somerfield

Trialling the new FSC trailer design

The newly designed Fuel Saving Curve (FSC) double-deck semi-trailer (illustrated below and on page 4) was tested against the standard double-deck semi-trailer at the Motor Industry Research Association (MIRA) test track in Nuneaton (Warwickshire). This initial prototype testing gave Somerfield confidence to order a first run of FSC semi-trailers. An in-fleet, in-use trial was then conducted over three days. A comparison was made between the fuel consumption of vehicles pulling standard and FSC trailers over a 590 km round trip, from Wellingborough NDC (Northants) to Bridgwater RDC (Somerset). The chart below illustrates the improved mpg performance recorded for the FSC vehicles.

Chart 1: Results of infleet trial

Wellingborough to Bridgwater mpg comparison

The FSC trailer gave an average of 3.07 km per litre compared to 2.85 km per litre using the standard trailer over the three trial days.

Potential savings

Using average consumption of **3.07 km per litre**, the Somerfield FSC trunking trailer averages **226,520 km per** year using **73,785 litres** of fuel at a cost of **£59,028** (80p per litre). The fuel saved by using the FSC design is **5,696 litres**, giving an annual saving of **£4,557**. This gives a fuel saving of over **7%** by using the aerodynamically styled double-deck trailer. The reduction in emissions is **15,265 kg per year** of CO_2 per vehicle.

CONCLUSION:

The case studies illustrate that significant fuel savings can be made by using aerodynamics on tractor units and semi-trailers.

The level of savings will depend on the type and size of vehicle, the travelling speed, the distances covered and also the nature of the operation.

Higher speed long-distance trunking operations are more likely to derive greater benefit from aerodynamic styling than short distance stop/start multi-drop urban delivery operations.

Fuel savings

Fuel savings from aerodynamic styling on a tractor unit account for up to **85%** of all aerodynamics-based fuel savings. So, even if you do not own any semi-trailers, it could be worth equipping your tractor unit with a cab roof deflector and cab extension panels. If you operate using a variety of different height semi-trailers, it is worth considering installing a variable height cab roof deflector.

Top aerodynamics tips:

- Vehicle specification
  Choose a specification to fit the maximum cargo volume that will be required but no bigger. The smaller the vehicle body, the smaller the frontal area and the less the aerodynamic drag

- The cab
  Make sure the cab size is appropriate for the type of work performed. Do not specify a cab greater in size than is absolutely necessary. The bigger the cab, the greater the vehicle's frontal area and the greater the aerodynamic drag

- Correctly adjusted equipment
  Adjustable aerodynamic equipment, such as a cab deflector, should be adjusted to the correct height for the vehicle. Incorrectly set equipment can actually increase drag and further reduce fuel efficiency

- The chassis
  Side panels on both sides of the tractor unit will cover the gap and reduce airflow between the front and rear tractor wheels

- Remember that trucks must comply with regulations covering their maximum permissible dimensions - make sure that any aerodynamic equipment fitted doesn't exceed those dimensions

Aerodynamic payback example:

- This is a worked example based on a cost of fitting aerodynamic equipment of **£1,400** for the tractor unit and **£1,400** for the semi-trailer, and assumes two semi-trailers per tractor unit, totalling **£4,200.** The equipment fitted includes a cab roof deflector, cab extension panels and mudguard panels, an air dam, a three-dimensional cab roof fairing on the tractor unit, side skirts, a curved edge on the roof, and a rear quarter panel on the trailer

- If these vehicles were used on long distance trunking-style work, travelling **100,000 km per year,** they might achieve a **13%** fuel saving. Based on 2.8 km per litre, this fuel saving equates to **4,643 litres per year** or £3,714 (80p per litre). The environmental benefit is 12,443 kg per year of CO_2 saved per vehicle

Annual saving	**£3,714**
Cost of modification	**£4,200**
Payback period	**13.5 months**

See Freight Best Practice guides **'Truck Aerodynamic Styling'** and **'The Streamlined Guide to Truck Aerodynamic Styling'** for more information on aerodynamics.

See **'In-fleet Trials of Fuel Saving Interventions for Trucks'** for more information on running your own in fleet-trials.

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