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In-Service Assessment of Agricultural Trailer Braking System Performance

- Agricultural Trailer Braking Study (ATBS)

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Investigation Background

An efficient vehicle braking system is central to safety during transport operations, be they on or off-road, but agricultural trailer (& trailed appliance) braking systems are frequently given insufficient consideration, both at the time of purchase and during subsequent use. Most UK agricultural trailers are fitted with braking systems designed to operate within the 20 mph (32 km/h) UK speed limit for unsuspended vehicles. However, virtually all UK tractors sold since 1995 have 25 mph (40 km/h) max. speed capability and many modern 'conventional' tractors are now capable of 30 mph (50 km/h) on-road. Whilst use of agricultural tractors above 20 mph is illegal without full suspension and commercial vehicle-spec. braking performance (incl. ABS), in practice it is frequently viewed as a preferable alternative to increased frustration and recklessness on the part of other road users, as a consequence of experiencing excessive delays behind slow-moving agricultural vehicles.

Tractor-trailer operation at 30 mph increases the energy dissipation requirement placed upon the vehicle braking systems by over 140% (see Fig.1). Whilst modern tractor systems have been engineered to accommodate this increase, trailer braking systems frequently have not: a situation accentuated by the fact that agricultural trailers are frequently expected to have a frontline service life of 20 - 25 years. A trailer can easily outlive two or more generations of tractor, but only if the running gear and braking system are adequately specified in the first instance. If the trailer braking system is undersized, the initial consequence is accelerated wear and premature failure of the trailer braking system, followed by overloading, rapid wear and eventual failure of tractor braking system. This has become an increasing problem within the UK and Ireland in recent years.

In addition to current 'in-service' issues, forthcoming EU tractor-trailer braking legislation will demand higher performance from new tractor and trailer braking systems, although in practice the degree of improvement required of trailer systems will be far greater than those of the tractor, as the latter frequently meet the new requirements already. However, improving tractor braking performance, in response to higher road speeds and in anticipation of future legislation, has served to increase the performance gap between tractor & trailer braking systems, further overloading the towing vehicle.

So what can be done to remedy the situation? This investigation seeks to highlight the extent of this problem in the UK at present and identify practical, cost-effective measures that may be implemented on-farm to address it. Better to buy the right spec. trailer when new, or re-condition an existing trailer at relatively modest cost by fitting suitable running gear and appropriately-sized brakes, rather than have to replace oil-immersed tractor brakes at £2000 per instance? If buying a new trailer, how can braking system specification affect not only braking performance, but subsequent service intervals and running costs? Can it actually make good economic sense to upgrade the braking systems of older trailers which remain in regular use, particularly if operated behind modern 30 mph / 50 km/h 'conventional' tractors? Are some trailer designs more suitable than others? What components are likely to be required and from where may they be sourced?

Information is required to highlight the relative attractiveness and practicality of these various options. This investigation, sponsored jointly by the HSE, the Department for Transport and a consortium of six tractor manufacturers (AGCO, CNH, Claas, JCB, John Deere & McCormick), via the Agricultural Engineers Association (AEA) is currently seeking answers to these questions.

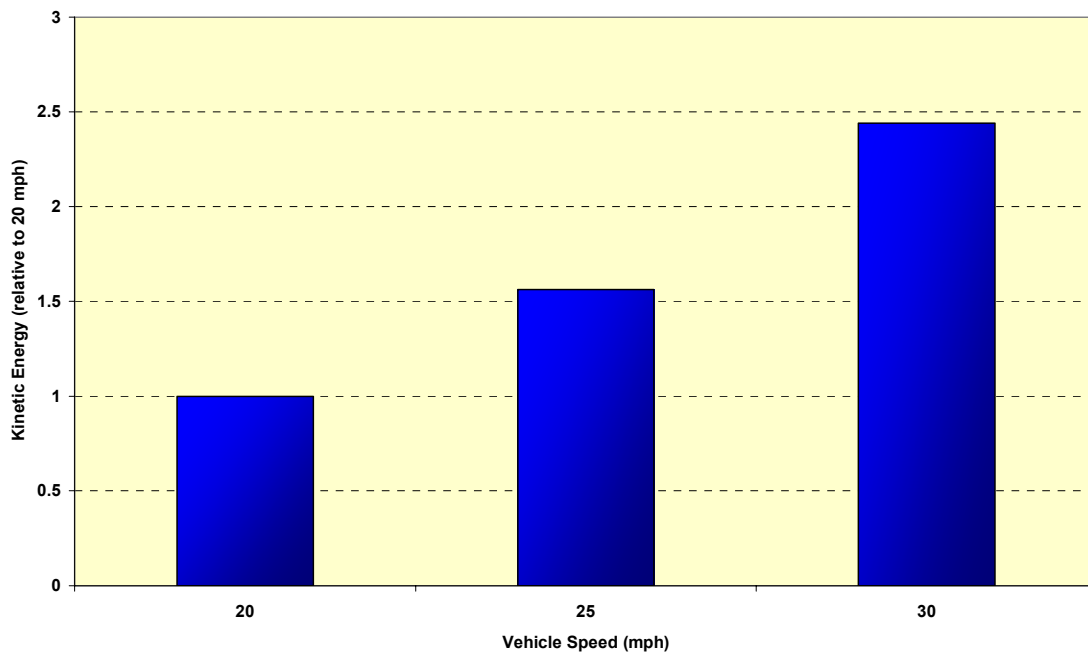


Figure 1:- Disproportionate effect of increasing speed upon vehicle kinetic energy

Aim, Objectives & Activities

Rather than generate data to penalise tractor-trailer transport, the main purpose of this work is to produce information to raise user (& prospective purchaser) awareness of the inadequate performance of many in-service agricultural trailer braking systems, and provide guidance regarding the practical means & economic viability of addressing the situation. This should in turn enable safer operation and assist compliance with future agricultural trailer and trailed appliance braking legislation, particular issues being:-

- the disparity between current tractor and trailer braking system performance;
- the economic and safety benefits of selecting adequate braking systems when purchasing new trailers and trailed appliances;
- the scope for (and economic benefits of) voluntarily upgrading existing trailer / trailed appliance braking systems to meet the requirements of forthcoming EU legislation;
- the need for regular maintenance of agricultural trailer braking systems.

To meet these objectives the investigation is in the process of targeting a small but representative range of typical agricultural trailers and trailed appliances (e.g. slurry tankers, big balers). Suitable examples (i.e. those capable of a further 10 years frontline use) are collected from participating farms, are ballasted and have their service and parking brake performance tested in 'as-found' condition. Their braking systems are then inspected and serviced by our trained staff (including brake shoe replacement if necessary) prior to re-testing and return to farm. Each example trailer is then documented as a case study, braking performance shortfalls (if any) being highlighted and the feasibility of physical modifications to address the situation is considered, both in terms of practicality and economic viability. These case studies will then form the basis of an HSE / DfT / Industry publicity campaign at shows and events during Summer – Winter 2008.

Table 1: Tandem-axle tipping trailers investigated to-date

Age	Nominal Capacity	Undergear Type	Brake Size (mm)
1999	14 tonnes	Single-leaf spring	400 x 80
2001	14 tonnes	Multi-leaf spring	400 x 80
1987	14 tonnes	Single-leaf spring	300 x 90
2007	16 tonnes	Single-leaf spring	420 x 180
1991	12 tonnes	Single-leaf spring	420 x 180
1993	14 tonnes	Rocking beam	400 x 80
1978	16 tonnes	Single-leaf spring	420 x 180



Figure 2:- Selection of trailers tested to-date

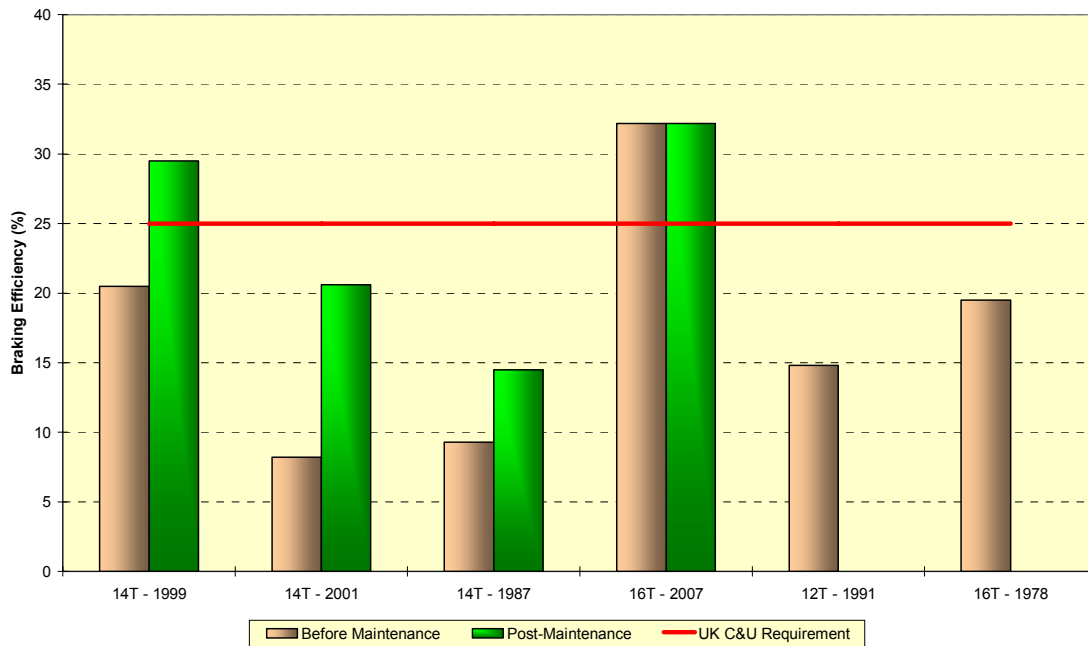


Figure 3:- Trailer service brake performance (@ 100 bar hydraulic line pressure)

Initial Findings

This investigation is in-progress and so it would be premature to draw conclusions at this stage. However the trailer service brake performance results obtained to-date (see Fig.3) speak for themselves. UK Road Vehicles (Construction & Use) Regulations (1986) require agricultural trailers (when drawn at not more than 20 mph) “to be capable of achieving a braking efficiency of not less than 25%”. If drawn above 20 mph, the Regulations require 50% (min) braking efficiency – the same as Large Goods Vehicles. Incidentally France requires an agricultural trailer braking efficiency of 35% (min), whereas Italy stipulates 40% (min): future EU tractor-trailer braking regulations are likely to require 50% (min) braking efficiency; in line with that achievable by most modern 4wd tractors.

To summarise, of the trailers test to-date:-

- Only one trailer achieved the current UK service braking performance requirement for (<=20 mph) agricultural trailers, when tested in ‘as-found’ condition. It was 3 months-old;
- Even following workshop overhaul, the service braking systems of some (modern & apparently serviceable) trailers still failed to meet statutory performance requirements;
- In all cases, parking brake performance was inadequate, both pre and post-maintenance;
- Lack of braking system maintenance on-farm is an issue, but braking system design (to encourage maintenance and promote system longevity) is also a factor;
- None of the trailers tested are ‘legally’ permitted to be used at 25 mph (40 km/h), let alone 30 mph (50 km/h). Their suitability in practice may be open to discussion, but inability to meet performance requirements originating from the late 1970’s does little to support their case.

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