



European, American and Australian *BRAKING SYSTEMS*

Australia arguably has the greatest variety of trucks in its market than any other country. From small 4.5 tonne run-arounds in the city, to 160 tonne quad road-trains running on unsealed outback roads. From Australian designed and built trucks to fully imported trucks from Europe, the USA, Canada and Japan. The nature of this variety and the ingenuity of the Australian trucking industry creates an environment where world-leading vehicle designs and products are created that can improve vehicle manoeuvrability, reduce running costs, increase efficiency and improve safety. This diversity of vehicles however, also produces challenges for vehicle builders, equipment suppliers, government bodies and not least of all operators.

We have had challenges with braking compatibility of heavy vehicle combinations for decades; issues such as poor braking performance, poor braking stability and excessive pad/lining wear. These problems occur because of different braking standards, poor setup of braking systems and use of incorrect parts for in-service replacement. In particular, I will focus on the different braking standards and design philosophies that exist and the on-road consequences.

European manufactured trucks and trailers are built to United Nations Economic Commission for Europe (ECE) – Regulation 13 braking requirements. Japanese trucks are also typically built to ECE-R13. North American built vehicles must comply with either US FMVSS-121 or its close cousin Canadian CMVSS 121. Australian-built trucks comply with ADR-35/02 and Australian-built trailers with ADR-38/03.

There are two main differences between the ECE Regulation 13 vehicles and the rest. Firstly, ECE Regulation 13 vehicles have adaptive braking systems. That is, the brake capacity is reduced when the load is reduced. Vehicles either have load sensing brakes with ABS or EBS.

Secondly, the wheels on a rear axle must not lock-up earlier

than wheels on a front axle. This results in more powerful front axle brakes on an ECE-R13 truck than on a North American or Australian truck.

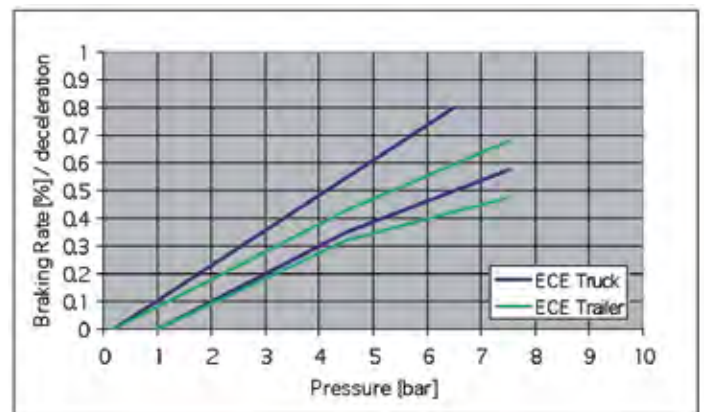


Figure 1 The ECE Reg 13 laden compatibility limits

Figure 1 shows the ECE Reg 13 Truck and Trailer compatibility limits for a typical 6x4 prime-mover towing a 3-axle semi trailer in the laden case. The deceleration under braking at each pressure must be between the respective upper and lower limits.

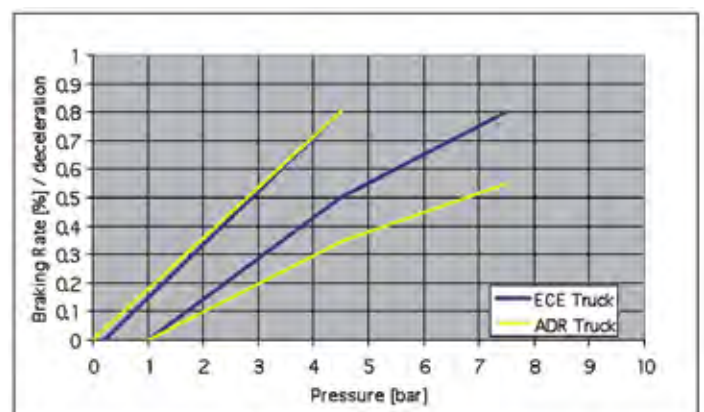


Figure 2 The ADR laden compatibility limits

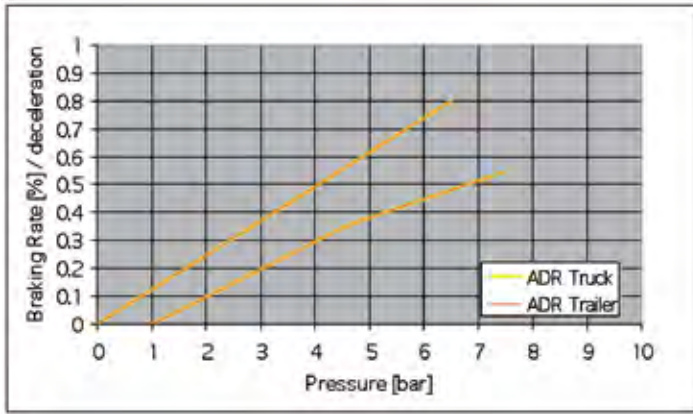


Figure 3 Comparison of ECE Reg 13 and ADR lightly laden truck compatibility limits

Note that the Reg 13 trailer brake capacity is typically lower than that of the ECE Reg 13 prime mover. This is done deliberately to allow for weight transfer from the trailer onto the truck during heavy braking. Figure 2 shows the Australian (ADR) brake compatibility limits for the same vehicle combination also in the laden case. Notice that there is no difference in the truck and trailer curves to take into account load transfer from the trailer to the truck during braking. Now consider the lightly laden truck or trailer, as shown in Figures 3 and 4. The most notable difference is that the ECE compatibility limits are significantly tighter. Tighter curves reduce the allowable brake power variations between different vehicles, which helps to limit possible incompatibilities.

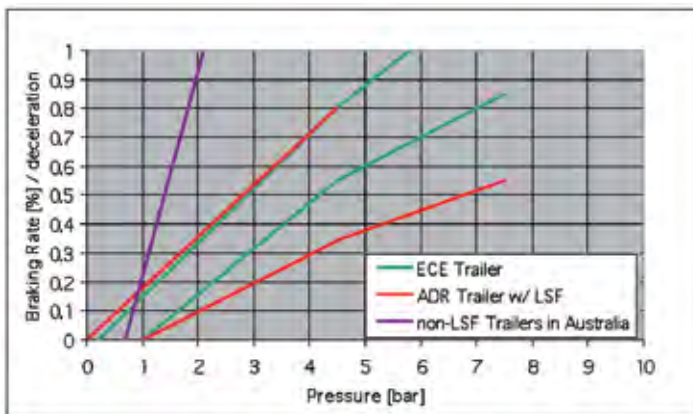


Figure 4 Comparison of ECE Reg 13 and ADR lightly laden trailer compatibility limits. LSF is *load sensing function*.

The most significant difference between European and North American (and Australian) trucks is not evident from the curves. European trucks meet the limits. Australian trucks meet the limits only when they have a Load Sensing Brake Function (LSF).

In Figure 4 I have also shown where a typical Australian semi trailer performance curve would be when it does not have a Load Sensing Brake System fitted. When the curve is high, as seen in Figure 4, gross wheel lock-up will occur at low control levels. Because the prime mover curve on a lightly laden vehicle is usually much lower than that of the trailer, the brake balance on most lightly laden Australian semi-trailers is poor.

If Australia were to adopt the ECE-Reg 13 limit curves there would be improved brake compatibility between trucks and trailers.

The benefits of improved braking balance are shorter stopping performance of vehicle combinations, better directional stability during heavy braking and more even brake wear. These are significant benefits.

Australia is now part of the electronic braking control revolution. An Electronic Brake Control System (EBS) may now manage the braking. It knows all the sensed wheel speeds, the steering wheel direction and the lateral (yaw) acceleration. An Electronic Stability Control System (ESC) to correct poor directional control during braking can now be made automatically.

Taking this one step further, with the advent of multi-volt trailer EBS also came dual load sensing functions. The trailer EBS can be set up to automatically match the trailer braking performance to both a truck without adaptive brakes (North American or Australian) or a truck with adaptive brakes (European or Japanese). This is ideal for fleets with a mix of both European and American type trucks.

In summary, the main differences between North American/Australian and European/Japanese heavy vehicle brake systems are:

- A European/Japanese truck probably has more powerful front axle brakes.
- A European/Japanese truck and trailer probably have adaptive brakes (EBS or load-sensing valves).
- A European trailer probably has less powerful brakes than the Australian-made trailer, particularly when lightly laden.
- European EBS or ESC is probably programmed assuming the truck is pulling a European trailer.
- A European truck is likely to have disc brakes whilst the North American/Australian truck is likely to have drum brakes.
- A European truck is likely to have either a predominance valve that allows a screwdriver adjustment of the compatibility brake balance, or an EBS that can be programmed to give the trailer a lag or lead.
- A European trailer will have an EBS whilst the Australian trailer usually has no electronics.

By Robert Smedley,
Senior OEM Application Engineer,
Knorr-Bremse Australia