

# **Electronic Braking Systems**

**Anders Lundström**  
**Scania**

Presented to the

Institute of Road Transport Engineers of New Zealand

**SEVENTH INTERNATIONAL HEAVY VEHICLE SEMINAR**

**WELLINGTON**

**16 & 17 July 1998**

Anders Lundström, Manager Chassis Development Laboratory, Scania,  
Södertälje, Sweden

### **Scania and electronically operated disc brakes**

With the 4-series Scania introduced, as an option, electronically operated disc brakes on all axles for most tractors and trucks in our program. In our opinion this is a quite natural step in brake technology following the introduction of power-assisted brakes, two-circuit technology, automatic slack adjusters, load-sensing valves and anti-locking.

The electronically operated, pneumatically supplied disc brake system has several advantages to the pneumatically operated, pneumatically supplied drum brake system. The first advantage has to do with the use of wheel brakes in emergency braking of heavy vehicles, i.e. **traffic safety**. The pneumatically operated brake has a longer response time and a non-simultaneous first application of braking on front and rear axle. In fact, it takes about 0.6 seconds for all brakes to apply on a tractor-trailer combination. With electronic control the delay time for the rear axle is negligible.

As a consequence electronic brakes are fully applied after 0.3 seconds, as compared to 0.6 seconds for the conventional pneumatic system. Added to this, disc brakes have a slightly higher retardation power than drum brakes of comparable size (and are less susceptible to fade). In repeated tests with 40 tonnes tractor-trailer combinations on dry tarmac we have found that the emergency braking distance from 80 km/h to full stop is reduced from approximately 40 meters for the pneumatically operated drum brake combination to 35 meters for the electronically operated disc brake combination. The legal demand in the European Union is 66.6 meters so both systems are really effective as compared to legislation.

But in an emergency situation, the extra five meters could mean a lot. Five meters is the length of a passenger car.

The second advantage is that disc brakes are of a more simple design than drum brakes. You might say that the design is more symmetric and has less "unused" material. No more thinking about the differences in brake force application of the attracting versus the repelling brake shoe. This has the consequence of **decreasing the weight**. For a typical Scania 6x2 truck the weight reduction is more than 100 kilogrammes of unsprung mass. This at least shows that disc brake technology is a right step in the 100 year long development of trucks with higher payload/chassis weight quota.

The disc brakes technology more or less solves the problem of so called brake vibrations. Disc brake installations are less sensitive to rims that are out-of-plane and show none of the temperature-induced deformations of drums that sometimes occur in hilly countries and are felt as vibrations in the steering wheel. The vehicle with disc brakes is **more comfortable** to the driver. The awkward noise called brake squeal is practically eliminated. That is one of the reasons why Scania city buses and buses with individual front axle air suspension are equipped with disc brakes.

The fourth advantage will come to the owner. Due to the more even distribution of brake force between front and rear axles for the electronically operated disc brakes, brake pads on rear axle will be worn out at the same time as those on the front axle. From tests with costumers in long haulage we have concluded that at least one set of brake pads on rear axle (and almost one set of rear axle drums) will be saved during the first 800.000 kilometers of operation. There is a **long term cost benefit** which will be more evident, the more common disc brakes get. Here is also the reason why disc brakes were not introduced a long time ago. Brake pad life length was not good enough until recently.

Since the introduction of the 4-series, Scania has delivered several thousands of tractors and trucks fully equipped with electronically controlled disc brakes. No technical problems have been reported from customers as yet. This year adaptive brake force control was introduced, making even pad wear more precise. Scania is developing a system for adaptive control of the trailer brakes as well. We are as yet not fully satisfied with all functional qualities.

Scania is planning to have disc brakes on all truck types in a few years from now. The only exception might be vehicles for use in construction applications or "real dirty" off-road applications where the drum itself might act as shield against hard particles getting into the brake. We are currently investigating this in field tests with some of our customers.

In conclusion Scania is convinced that electronically controlled disc brakes is the right step in brake technology for heavy commercial vehicles.

- **The owner** will have less costs in the long run.
- **The society** will get a higher degree of traffic safety.
- **The driver** will have a safer and more comfortable vehicle.
- **The transport industry** will have a better platform for the next steps in braking technology whether these might be tyres with higher brake friction or systems for emergency stability control of articulated vehicles.