

# 10 EVALUATION OF A COMBINED ACCELERATOR-BRAKE PEDAL

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## ***10.1 Background***

Cars have been equipped with the same foot-pedal arrangement since the days of the A-Ford. The clutch is to the left, the accelerator to the right and the brake in the middle. The right foot should be used for pressing the accelerator and the brake. This arrangement guarantees, that the throttle is released as the driver brakes. However, it also means that the foot almost always is placed at a distance from the brake, that is, on the accelerator, thus movement time adds to brake reaction time. The foot may be inaccurately placed on the brake resulting in bad braking performance and it may even miss the brake and hit the accelerator. If the accelerator is pressed instead of the brake in a car with automatic transmission it can cause an instance of so called unintended acceleration (Schmidt 1989) The driver persists in pressing what he believes is the brake though it is the accelerator.

Misapplications of this kind are not so likely with manual transmission because the engine will rush as the clutch is depressed and the driver thus discovers the mistake. To reduce risk for misapplication the pedals are usually mounted at different levels, the brake is higher and closer to the driver. However, different levels cost extra movement time.

To overcome the drawbacks with the traditional pedals various combined accelerator-brake pedals have been constructed. All of these constructions have been more or less impractical but a new Swedish solution seems to fulfil technical and ergonomic requirements.

## **10.2 The combined accelerator-brake pedal**

The basic idea with the combined accelerator-brake pedal is to eliminate movement of the foot between the accelerator and the brake. Several benefits will follow:

First, brake-reaction time is reduced. Studies on Winkelman's pedal showed a reduction of up to 0,2 seconds (Higginbotham & Frost 1972, Konz et. al. 1971, Pooch et.al. 1973).

Second, the foot is constantly on the brake in an optimal position, no risk for misapplication.

Third, acceleration and braking involves different groups of muscles. Conventional pedals are manoeuvred with the same movement albeit with rather different forces.

Fourth, the braking movement, to reach out with the leg parallels probably an inherited reflex. It is also the natural way to reduce speed as one is walking or running. Possibly, this pedal allows for more "natural" driving.

The new combined pedal was invented by Mr. Sven Gustafsson, who came up with the idea during his travels with buses and lorries as a professional driver. The pedal is mounted in the same position as the conventional accelerator. The right foot is placed on the pedal and should stay there during the drive. A heel support prevents the foot from slipping off the pedal. When accelerating, the driver pushes with the forefoot in the usual manner and when braking the driver pushes with the whole foot. The throttle does not have to be released, that is, it is not necessary to lift the forefoot before braking, a sensor cuts off the throttle as the brake is affected. To avoid unintended braking a solenoid gives extra resistance at the start of the brake movement. In case the driver mixes up pedal systems and moves the foot unnecessarily an extra brake pedal is mounted to the side of the combined pedal in the normal position of a conventional brake pedal. To counterweight the individual driver's leg the solenoid and the return spring of the brake is adjustable. For technical reasons smooth function of the combined pedal presupposes electrical gas which is rather rare in passenger cars.

### **References:**

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