BREAKING WITH THE COUPLED ENGINE

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Abstract

Studies on driving led to the conclusion that many drivers stop the engine or switch off the ignition while driving in order to save fuel and this entails dangerous consequences. In fact the experimental determinations performed prove that the best braking is by having the ignition on; it reduces the braking distance, it avoids locking up the tires by keeping at the same time the vehicle stability.

Key words: switched on engine, switched off engine, vehicle stability

Part of the driving accidents is caused also by the fact that some drivers brake by having the ignition off in order to save fuel. The braking method used and recommended is the one with the engine on.

In this situation part of the vehicle energy is lost in order to overcome the segments friction of the piston on the cylinder, the friction in bearings of the crankshaft and of auxiliary mechanisms; also a mechanical work is produced because the engine acts as a compressor. (Cristea P., 1966; Fratila G. and Marculescu, 1986; Ghiulai C., 1975; Untaru M. et al, 1981).

1. BRAKING WITH THE ENGINE SWITCHED ON

In case of braking with the engine switched on, it grows not only the braking interval but also the possibility of locking up the wheels due to the idle interval of the engine.

The braking effect of the engine will increase if the vehicle is equipped by the manufacturer with a device able, while braking, to increase the resistance when exhausting the gas burnt.

Thus, if during the process of braking the ignition remains connected to the transmission, the mechanical resistances of the engine determine the appearance of a supplementary braking interval which adds to the desired effect.

In the braking interval with the ignition on, the absolute deceleration is given by the relation: a_{fm} where:

$$a_{fm} = -\frac{dv}{dt} = \frac{1}{\partial \cdot ma}\left(F_f + F_{fm} + \sum R\right) \quad (1)$$

Where: F_f -reprezents the braking force developed by the car brakets; F_{fm} -reprezents the engine braking force reduced to the wheeles; $\sum R$-reprezents the sum of the resistances when car advances; ∂-reprezents the rotation masses control while braking with the engine switched off; m_a -reprezents the mass of the car.

2. BRAKING WITH THE ENGINE SWITCHED OFF

When braking on a driving surface with the engine switched off, the absolute deceleration will be as follows:

$$a_f = -\frac{dv}{dt} = \frac{1}{\partial' \cdot ma}\left(F_f + \sum R\right) \quad (2)$$

∂' -Factor of the rotating masses while braking with the engine switched off;

By comparing the two relations (1, 2) it becomes obvious that braking with the engine switched on is more efficient than with the engine switched off, situation in which

$$a_{fm} > a_f \;\; 3) \text{ or } F_{fm} > \left(F_f + \sum R\right)\frac{\partial - \partial'}{\partial'} \quad (4)$$

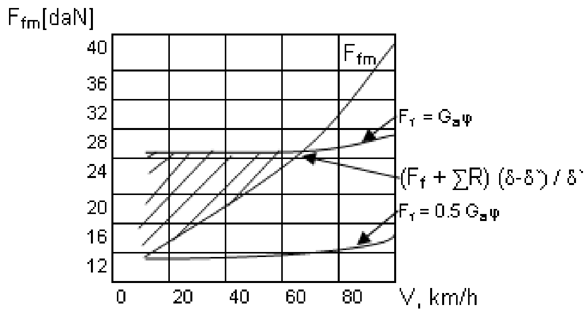

Figure 1 **Presents the relation (4) for a car.**

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The curve F_{fm} was drawn according to the experimental determinations on stand.

The hachured area between F_{fm} and F_f shows when breaking with the engine off is inefficient.

3. RESULTS OF EXPERIMENTAL DETERMINATIONS

The process of checking the braking performances is included in STAS 11960-84 and in the ECE Norms ONU13/06 amendment 09.

The experimental determinations in the figure 1, ere realized in Testing Laboratories in Craiova city, Romania, by using a vehicle without ABS.

The braking performances of the cars were determined without locking up the wheels (the pressing forces on the brake pedal had the biggest possible values so as not to block the vehicle wheels). The experiment was repeated several times with the engine both switched on and off.

Table 1.

Sequence with the engine switched off

	Speed 80	Effort control [daN]	Stopping distance [m]		Average deceleration in m/s^2	
			Obtained	Predicted	Obtained	Predicted
Loaded		20	36.9	50.7	6.6	5.8
Empty		16	32.4		6.8	

Table 2.

Sequence with the engine switched on

	Speed [km/h]	Effort control [daN]	Stopping distance[m]
Loaded	54 100 144	16 14 11	17.5 67.1 138.4
Empty	54 100 144	14 12 10	16.0 52.0 134

CONCLUSIONS

The experimental determinations performed both on stand and in the training area proved that:

-In the case of braking with the engine switched on, in similar conditions, a supplementary F_{fm} force appears being caused by the frictions in the engine and transmission; the result of this is that the maxim superior force FfR at wheel braking is smaller than in the case of braking with the engine switched off.

-The advantage of braking with the engine switched on is that the appearance of supplementary wheel braking interval MfR needs an Mf braking interval accomplished by the smaller braking system. As a consequence it reduces the locking up effect caused by braking when a total sliding of the wheel happens and poor stability of the car can be avoided.

-While driving it is recommended to always use braking with the engine switched on because the inertia of the steering wheel and the components linked to it act as a regulating factor of the wheel braking force developed by avoiding wheel locking up and by maintaining the car stability.

REFERENCES

Cristea P., 1966 - *Automobile Practice, vol.2*, Technical Publishing House, Bucharest.

Fratila G. and Marculescu, 1986 - *Vehicle Braking Systems,* Technical Publishing Hose, Bucharest.

Ghiulai C., 1975 - *Automobile Dynamics*, Didactical and Pedagogical Publishing House, Bucharest.

Untaru M., Potincu Gh., Stoicescu A., Peres Gh., Tabacu P., 1981 - *Vehicle Dynamics,* Didactical and Pedagogical Publishing House, Bucharest.