THE WATER FRICTION BETWEEN THE WIPER BLADE AND THE WINDSHIELD

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Abstract: The paper presents the wiping performance test and evaluation the windshield wiper blade after the water friction between this and the windshield, with different speed. After tests will be done, the results will be collect and compare, but in the paper present only the representative charts.

1. INTRODUCTION:

The windshield wiper mechanisms have as main objective to assure optimal conditions of visibility. They have to accomplish a series of conditions about cleaning area, but the long live for wiper components too. So, the windshield wiper blade must be made from a quality material for a long utility (500.000 cycles) without deflection, striation, or any defections [1].

With a test stand (like *Tribometer type TRM 5000*), a desk computer and a program for capture the results test (*TRIBO software*) we can analyses the results datum.

2. TECHNICAL REQUIREMENTS

The working operation of the windshield wiper mechanism is the reciprocating motion of wiper blade from one limit line of effective wiping area to the other line, and is also called cycle.

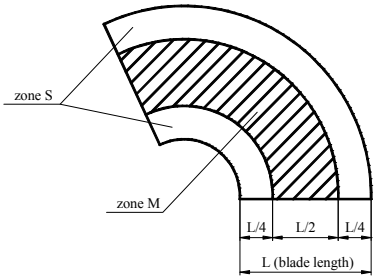

Fig. 1: Effective cleaning surface.

The part of a glass surface which is wiped off with wiper blade operation (effective cleaning surface) is composing from two zones (zone M and zone S), show in figure 1 [2].

The table 1 show the number of un-wiped marks after wiping test shall not exceed

the limit, where the terms used for evaluation meaning:

Hair line - Un-wiped area of below 0.5 mm in a very fine linear shape;
Heavier line - Un-wiped area of width below 1 mm in a fine linear shape;
Wide line - Un-wiped area of width about 1 ~ 20 mm in a band shape. It includes a group of fine and heavier lines and un-wiped membranes;
Zone M - Shaded portion of area wiped by blade movement (figure 1);
Zone S - Wiped area other than Zone M (figure 1).

Table 1.

Zone M			Zone S		
Hair line	Heavier line	Wide line	Hair line	Heavier line	Wide line
3	1	0	5	2	0

The testing stand (*Tribometer type TRM 5000*) can use for simulation the friction and the wear proceeding to the plane friction solicitation.

Can be analyzing the water friction (with more lubricant agent), wet or without lubricant fluid agent (the dry friction).

The principle of the experiments is to effect between a rotation axle who action the wiper arm and this, with a right definite normal force is push down on a fix sample (the windshield). The both samples are emplaced perpendicular with the rotation axle in superior position. The normal force is realized with a lever system that can be variable by displacing a rider weight at 0 to 5000 N.

Fig. 2: Tribometer type TRM 5000 [3].

The rotation drive is possible with a transmission without regulation step by a servomotor with 1 rpm ÷ 8000 rpm.

The testing stand has in structure the driving motor and the solicitation components. All ensembles are fixed and guiding on two vertical supporting columns because their position will can be arrange on the vertical.

Also the windshield and the wiper arm can be in a closed basin that can get hot to 250ºC. In the samples time are continue verified the nominal force (with a sensor), the basin temperature (with a NiCr-Ni resistance) and the quantity of the material wear.

The wear is evaluated by measuring the different between the superior and the inferior samples. The measure is effectuated without contact with an inductive sensor for measuring the linear dimension.

The friction is measure by a sensor who measures the driving motor.

The measure signals are amplified and guide to the command unit for there will be ulterior worked.

3. EXPERIMENTAL

The samples are assembling in real contact and perpendicular with the normal force. After this, it connecting the testing stand to a desk computer where is install the TRIBO software which collect and transform the experimental datum in the digital format.

The input dates are the normal force, the rotational speed and the ambient temperature (or the basin temperature, if is necessary) and the output measures are the torque, the friction and the wear of the wiper blade.

The servomotor rotation speed who action the drive motor can be arranges term the user desire; so we use three different rotation speeds, corresponding for the three windshield wiper mechanism speeds. Use the wiper blade assembly on the wiper arm and the normal force is like a real condition too.

Also it cans information about friction between windshield and wiper blade from more contact points. We use three contact points: the middle of the wiper blade, where action wiper arm (corresponding to the zone M) and the two wiper blade extremities (corresponding to the zone S).

For verify the measure value in real time is for every measure value an analog output mode, who permit connection to a voltmeter.

Table 2.

The measure	The range	U.M.	Analog OUTPUT tension
Normal force	(0 – 5000) N	N	5N = 10mV
Wear	± 1 mm	µm	1µm = 10mV
Torque	± 10 Nm	Nm	1Nm = 1V
Temperature	(ambient temperature ÷ 1000)ºC	ºC	1ºC = 10mV

Throw out of motion the servomotor is possible (command) after an initial determinate time or if is exceed the wear who was initial determined.

4. RESULTS AND CONCLUSIONS

Command the servomotor to end after 30 sec. capture and analyses the all results datum; but the following graphics represent only the water friction between the wiper blade and the windshield, with three speeds (slow, medium and fast) for every three contact points (the middle wiper blade (figure 4), the extremity nearby and the wide of to the rotation axle (figures 3 and 5).

The final graphic (figure 6) presented all three contact points with the medium speed only, because is representative for the rest speed too.

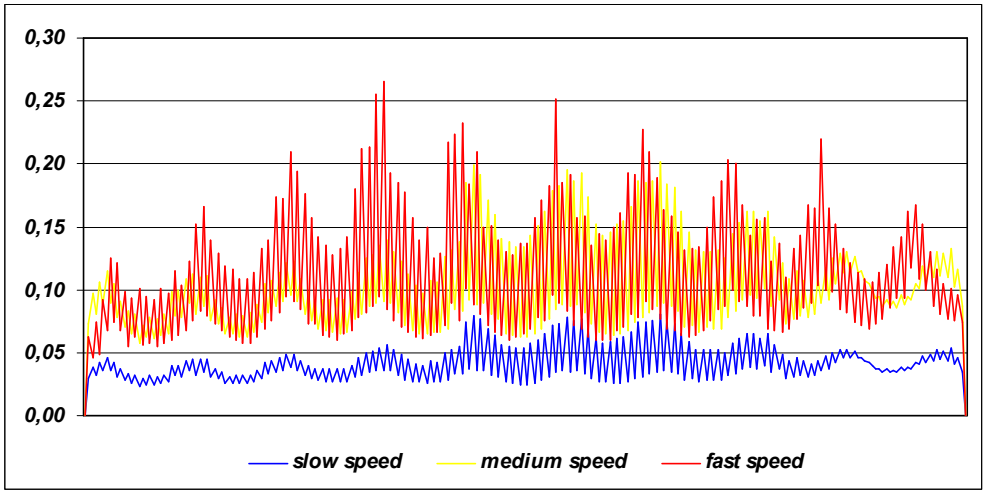

Fig. 3: The contact points from extremity blade nearby to the rotation axle.

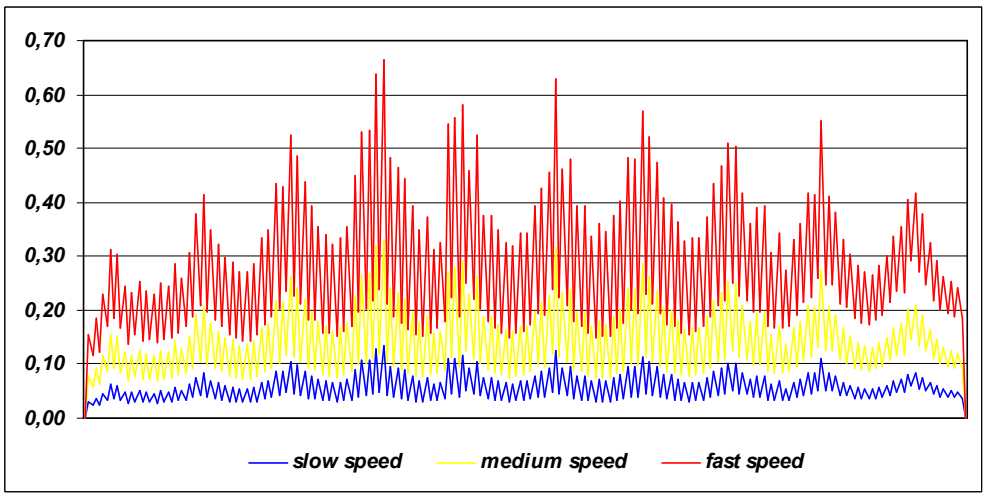

Fig. 4: The contact points from the middle wiper blade.

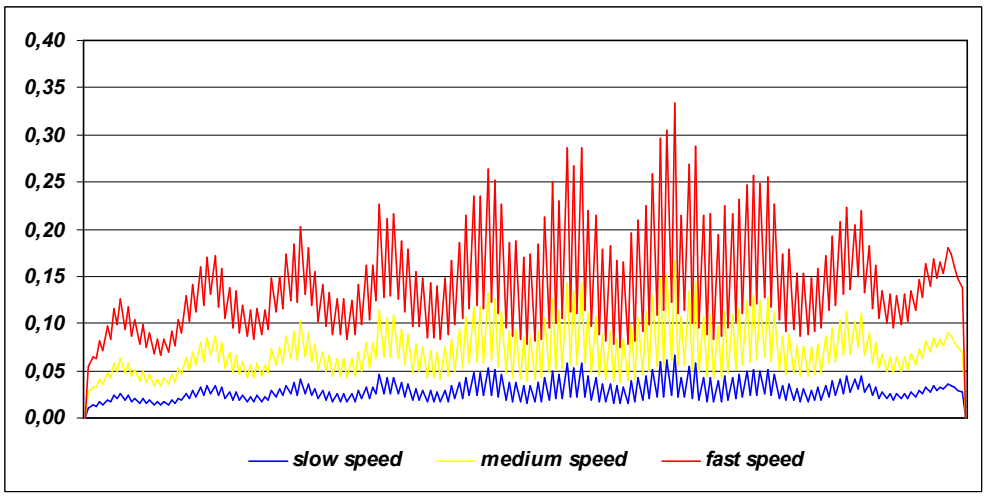

Fig. 5: The contact points from extremity blade wide of the rotation axle.

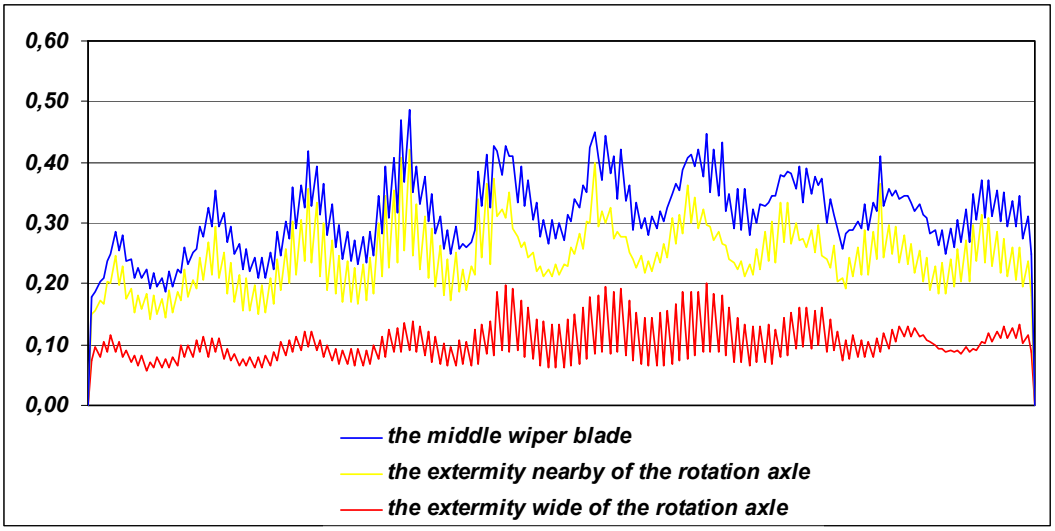

Fig. 6: Compare all three contact points, with the same speed.

From comparative analysis we can do the following conclusions:

- if is the low speed then is the fine friction too, but if is the high speed then is the hard friction;
- at the begin of the experimental tests is the rare friction frequencies and approaching to the end, the friction frequencies is more dense;
- the better value for friction is in the middle wiper blade, next value is the friction from the extremity nearby to the rotation axle and the other extremity is the slight friction value.

5. ACKNOWLEDGMENTS

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