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ANALYTICAL DEPENDENCES OF DEFINITION OF SPEED OF TRANSPORT MEANS ON BASIS OF LAWS OF CONSERVATION OF ENERGY AND MOMENTUM

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The method is based on determining the energy cost of moving the vehicle when replot after the collision. It is known from theoretical mechanics, the amount of traffic some of the system will be constant in magnitude and direction if the resultant vector of external forces acting on system is zero.

Vector resultant momentum of the two cars before the collision and after it remains unchanged in magnitude and direction.

Consequently, the parallelogram built on the vectors of momentum of the cars before the collision and after it, will have a common diagonal, is a vector of the resultant momentum of the car at the time of their collision (Fig. 1).

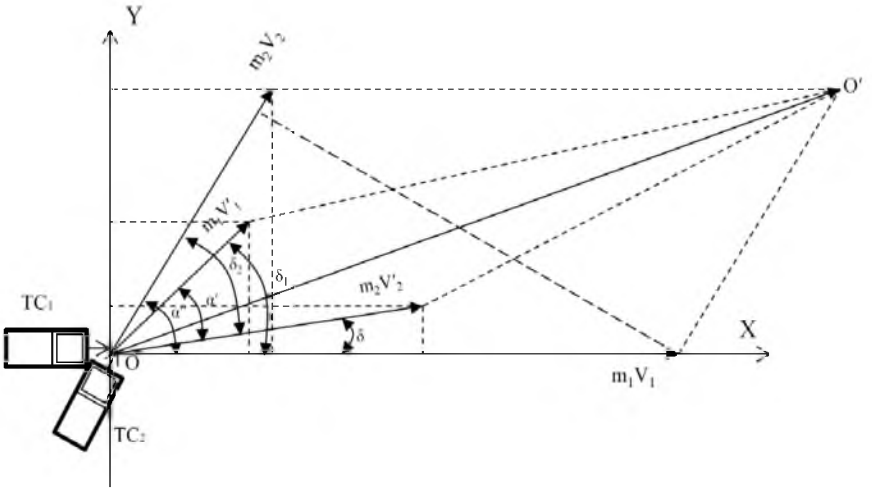

Fig. 1. – **Relationship of vectors of momentum of vehicles before and after collision.**

All the main parameters of the collision process can be divided into two groups: parameters that determine the change in the rate of movement of the vehicle, and the parameters that determine the mutual positions them at the moment of impact. The main parameters that determine the change in speed and direction of movement of the vehicle, include the following values:

- speed of vehicles at the time of initial contact in the collision V_1 and V_2;
- speed of the vehicles immediately after impact V'_1 and V'_2;
- the angle between the directions of motion at the moment of impact (angle of incidence) α";
- the deflection angle of the direction of movement of vehicles after impact (tilt angle) δ_1, δ_2;

- the angle between the directions of travel of vehicles after impact (divergence angle) α';

- the angle between the directions of movement of the vehicle 1 before the collision and the vehicle 2 δ after its.

To determine the speed of the vehicle directly before traffic accidents it is necessary to choose coordinate axes so that the origin passes through the point of contact of V. the Axis OX will direct in the direction of motion of the vehicle 1 to the vehicle collision, the axis OY perpendicular to the OX axis.

The vector momentum before the collision will move through their action at the origin of coordinates. On the basis of the law of conservation of momentum are:

$$\overline{m_1 * V_1} + \overline{m_2 * V_2} = \overline{m_1 * V_1'} + \overline{m_2 * V_2'} = const, \quad (1)$$

where: m_1 and m_2 – masses of vehicles 1 and 2; V_1 and V_2 – speed of vehicles vehicle 2 and vehicle 2 to the collision, V'_1 and V'_2 – speed vehicles, vehicle 1 and vehicle 2 after the collision.

Projecting the vectors of momentum on the coordinate axis. In projections on the axis OX of the equation (1) takes the form:

$$\overline{m_1 * V_1} + \overline{m_2 * V_2} + \cos\alpha'' = \overline{m_1 * V_1'} * \cos\delta_1 + \overline{m_2 * V_2'} + \cos\delta_1. \quad (2)$$

In projection onto the axis OY

$$0 + \overline{m_2 * V_2} * \cos 90 - \alpha'' = \overline{m_1 * V_1'} * \cos 90 - \delta_1 + \overline{m_2 * V_2'} * \cos 90 - \delta, \quad (3)$$

or

$$\overline{m_2 * V_2'} * \sin\alpha'' * \overline{m_1 * V_1'} * \sin\delta_1 * \overline{m_2 * V_2'} * \sin\delta, \quad (4)$$

Equations (3) and (4) determine the relationship of vectors of momentum in the chosen coordinate system.

Speed of vehicles V'_1 and V'_2 after the collision can be determined on the basis of the law of conservation of energy, based on the equality of the kinetic energy of the vehicle at the expansion stage and the work of the forces to overcome the resistance to movement of the vehicle on the way of expansion to a full stop, but it:

$$\frac{m*V^2}{2} = m * g * \varphi * S, \quad (5)$$

where: m – vehicle mass, kg; g – acceleration of free fall, g = 9.81 m/sec^2, φ – coefficient of adhesion in transverse direction, V – velocity of vehicle, m/s, S – path of expansion of the vehicle after the collision, m.

Then TN_1:

$$\boldsymbol{V_1' = \sqrt{\frac{2}{m_1} A_1} = \sqrt{\frac{2*12.96*m_1*g*S_1}{m_1}} = \sqrt{254 * \varphi * S_1},} \quad (6)$$

Similarly for TN_2:

$$\boldsymbol{V_2' = \sqrt{254 * \varphi * S_2},} \quad (7)$$

Knowing the angles between the directions of movement and angles of deflection (installed from the analysis of schemes of road accidents) (4) determine V_2, and then from (2) – V_1.

Despite the obvious physical nature of this method of determining speed, it is not always used in expert practice. The reasons for this are related to more complex calculations in comparison with the second method. However, the method is considered to be the most "viable" market autoexperts, because it is relatively simple

to implement, does not depend on explanations of participants of road accidents, does not require the vehicle to an expert examination - enough photo.

The latter point is important, because it often happens that the examiner is required to permit inspection of the vehicle in the investigator or the judge, because the owners in most cases, object to inspection, but it delays the execution time of examination (for the law expert on the execution of the examination is given 30 days.

The analysis of numerous expert tasks carried out by the described method, showed that the vast majority of experts in the reconstruction of traffic accidents does not take into account the availability on the paths of movement of the vehicle before and after the collision different kinds of threshold obstacles, and the actual pivot angle of vehicles at impact.

This is due to contradictory opinions on the importance of accounting for lack of evidence-based information about the role of factors of turn of the vehicle after the collision and contact with the threshold obstacle to the formation of the total energy cost of extinguishing the kinetic energy of the vehicle at road traffic accidents.