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DEVELOPMENT OF A SECURITY PROGRAM FOR PLACING LOADS ON VEHICLES OF TRANSPORTATION

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Annotation
Nowadays, in order to safely deliver the goods to their owner, to reduce the impact of the loads on the stability of cars during the movement of the car, the loads are attached with special strap protection devices [1]. During the movement of the cargo placed on the platform of the transport vehicles, the center of gravity of the cargo moves from its place to a certain place, if errors are made in the placement and attachment of the cargo, it is inevitable that a road traffic accident will occur during transportation [2,3].
Theoretically, it is necessary to deal with reasons related to safe loading and attachment when finalizing the shipment process. It is necessary to take into account the technical capabilities of the car when carrying out the transportation of goods by means of transport, safe and high-quality transportation.

Keywords: load, vibration, motor train, connection, fiber belt, metal cable.

Introduction

Nowadays, in order to safely deliver the goods to their owner, to reduce the impact of the loads on the car's stability during the movement of the car, the loads are attached with special strap protection devices. During the movement of the cargo placed on the platform of the transport vehicles, the center of gravity of the cargo moves from its place to a certain place, if errors are made in the placement and attachment of the cargo, it is inevitable that a road traffic accident will occur during transportation [4-6].
Theoretically, it is necessary to deal with reasons related to safe loading and attachment when completing the transportation process. It is necessary to take into account the technical capabilities of the car when carrying out the transportation of goods by means of transport, safe and high-quality transportation [7-11].
The European Union is losing 800 million euros a year due to improper consolidation of goods (LasInfo Scientific Journal 2021) [12-13]. This is the statistics of the insurance campaign of the European Union. Such statistics have not been observed in the CIS countries to date, but no single basic evidence and normative documents have been developed to ensure the correct loading and attachment of cargo [14-16].
In his graduation work, he studied the international regulatory documents for safe loading and attachment of goods to vehicles, and based on this, developed a new method of calculating the stress on axles as a result of loading goods on trucks [17-20].
Production of a report on the rational and safe placement of cargo in a vehicle.
1. Analysis of the normative load on the axle of modern road trains
2. Review of modern methods of placing and locking loads on modern motor vehicles.

3. Production of a mathematical model of the loads falling on the axle of the vehicle, taking into account the displacement of the loads on them.
4. Development of the algorithm program of the loader, which loads them onto the axis when loading them into the train [21-23].
Increase the safety of the movement of road trains by safely loading the cargo onto the car.

VDI 2700 STANDARD REQUIREMENTS

Security requirements during cargo transportation.

European regulatory documents

• EN12195-1 "The structure of attaching loads to the vehicle. Safety" Part I "Calculation of Bonding Strength".
• EN12195-2 "The structure of attaching loads to the vehicle. Safety" Part II "Strengthening with fiber tapes".
• EN12195-3 "The structure of attaching loads to the vehicle. Safety" Part III "Chains for attachment".
• EN12195-4 "The structure of attaching loads to the vehicle. Safety" Part IV "Metal cables for fastening".
• EN12640 "Attachment of loads to road vehicles. Construction of the body of food-carrying vehicles".
EN12642 "Attachment of loads to road vehicles. Attachment point".

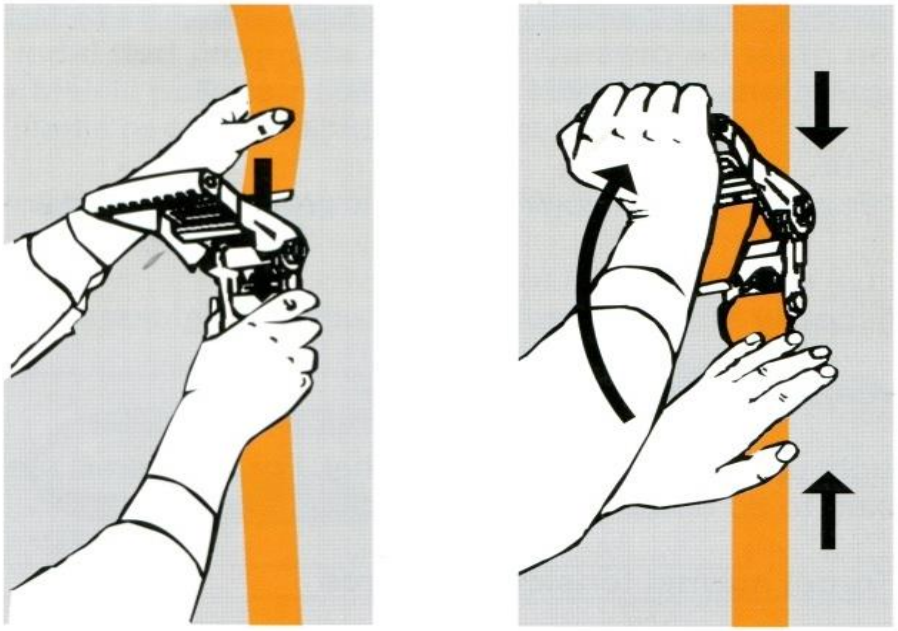


Figure 1. Using two-component attachment tapes

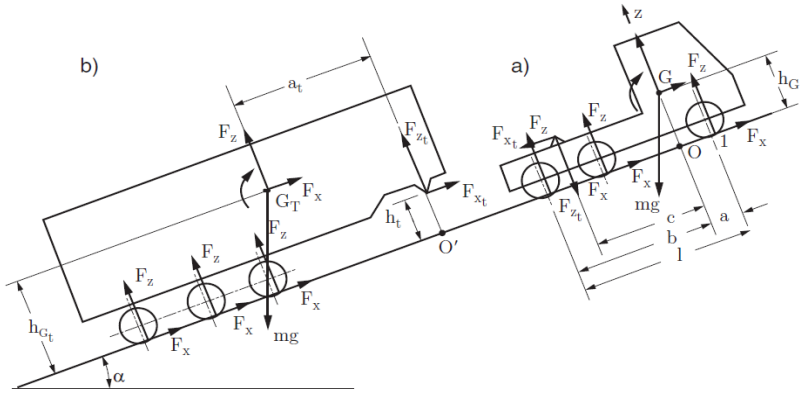
EN12195-2 "The structure of attaching loads to the vehicle. Safety" Part II "Strengthening with fiber tapes".

Figure 2. The appearance of the attachment strips

EN12195-2 "The structure of attaching loads to the vehicle. Safety" Part II "Strengthening with fiber tapes".

Figure 3. The appearance of the soles and the careful attachment method.

EN12195-1 "The structure of attaching loads to the vehicle. Safety" Part I "Calculation of Bonding Strength".



a) Car

$F_{x1}+F_{x2}+F_{x3}-F_{xt}-F_a-mg\sin a=mv$

$F_{z1}+F_{z2}+F_{z3}-F_{zt}-mg\cos a=0$

$F_{z1}\times aF_{z2}\times d-F_{z3}\times bF_{zt}\times C+(F_{x1}+F_{x2}+F_{z3})\times h_G-F_{xt}\times(h_G-h_t)=0\ F_{z2}$

$$\frac{1}{-d-a}\left(\frac{F_{z2}}{K_2}-\frac{F_{zt}}{K_t}\right)-\frac{1}{-b-a}\left(\frac{F_{z3}}{K_3}-\frac{F_{z1}}{K_1}\right)=0\rightarrow F_{z3}$$

b) Trailer

$\sum F_x=0\ F_{x4}+F_{x5}+F_{x6}+F_{xt}-m_t g\sin a=m_t\times v$

$\sum F_y=0\ F_{z4}+F_{z5}+F_{z6}+F_{zt}-m_t g\cos a=0\rightarrow F_{zt}$

$\sum M_y=0\ F_{zt}\times a_t-F_{z4}\times a_0-F_{z5}\times a_1-F_{z6}\times a_2-F_{xt}(h_{Gt}-h_t)=o\rightarrow F_{z5}$

$$\frac{Z_i - Z_1}{X_i - X_1} = \frac{Z_n - Z_1}{X_n - X_1} \Leftrightarrow z_i = \frac{F_{z1}}{K_1}$$

$$\frac{1}{-a_0 - a_t}\left(\frac{F_{z4}}{K_4} - \frac{F_{zt}}{K_t}\right) - \frac{1}{-a_1 - a_t}\left(\frac{F_{z5}}{K_5} - \frac{F_{zt}}{K_t}\right) = 0 \rightarrow F_{z4}$$

Sizes of the program

F_{x1} ; F_{x2} ; F_{x3} -forces on the driving wheels.

Fx4 ; _ F_{x5} ; F_{x6} - the forces acting on the wheels of the semi-trailer.

F_{xt} is the longitudinal inertial force acting on the joint.

F_a - aerodynamic forces.

F_z – inertia forces of the wheel.

F_{zt} – the reaction force of the coupling equipment

m_p , m_t - the total mass of the tractor and semi-trailer.

h_G is the height of the center of theft of the semi-trailer.

V is the speed of the train.

a - elevation angle.

h is the height of the center of theft of the leader.

g – acceleration of free fall (9.8 m / s^2).

h_C is the height of the coupling device.

K_1 ; K2 ; _ K_3 – Car thoroughness check.

K_4 ; K_5 ; K_6 - Checking the accuracy of the trailer.

Matlab/Simulink algorithm software results.

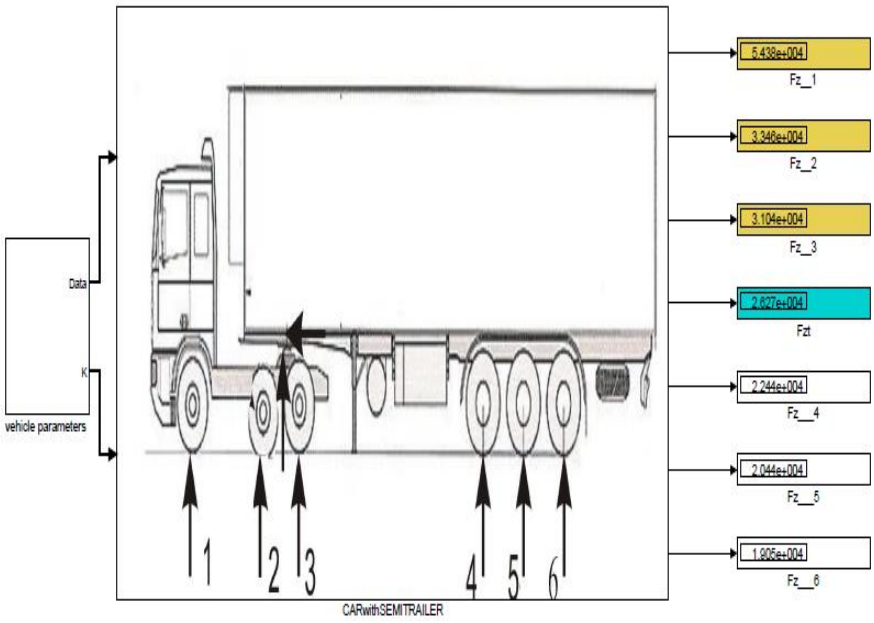


Figure 5. Matlab/Simulink. The program and algorithm model for calculating the stress on the axles according to the mass and location of the loads .

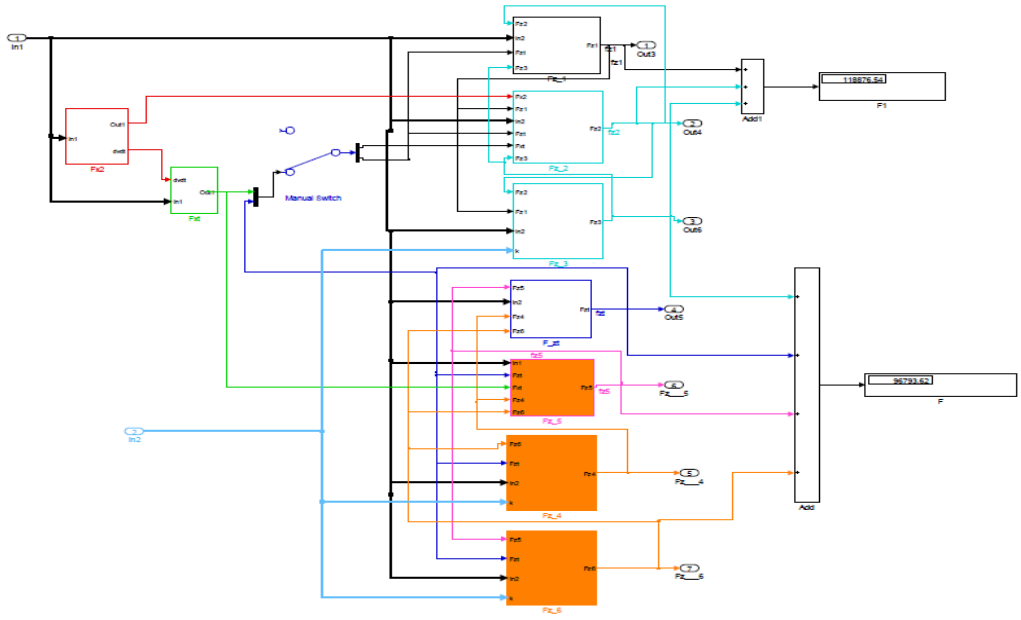


Figure 6-6. A model for calculating the stress on the axles.

Research was conducted on the topic of developing a safety program for placing loads on vehicles, proposals and conclusions were drawn up. Modernization of our economy, technical and technological renewal, sharp increase of its competitiveness, improvement of the process of international cargo transportation to increase the export potential. It is necessary to introduce international standards to ensure the level of transportation safety.

In order to increase the security level of cargo loading and attachment, issues related to placing the cargo in the most convenient place and delivering the cargo to their owners were considered. Because the loss of the European Union according to the annual statistics of 2021 was 800,000,000 €. At present, such an amount was not observed in the CIS countries. The growth of the country's economy, the increase in the volume of export and import forces us to think about the safety of the cargo transportation process. Therefore, the introduction of international standards is one of the urgent problems of the day. The VDI 2700 standard was developed according to the German standards and is currently implemented in Europe, USA, Japan, China, India, and African countries. Implementation of this standard is being carried out by the International Automobile Transport Association (ASMAP) in Uzbekistan.

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