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FEATURES OF LONGITUDINAL AND TRANSVERSE STABILITY OF VEHICLES

Annotation: The article considers the schemes of forces acting on a stationary tracked vehicle on an ascent and slope, as well as on a support surface with a transverse slope. The methods of experimental determination of the coordinates of the center of gravity of the machine, static angles of longitudinal and transverse stability are given.

Keywords: longitudinal slope; transverse slope; longitudinal stability; transverse stability; angles of stability of the machine; increasing the stability of the vehicle.

Special requirements for the design of cross-country vehicles, complex extreme technological processes that they perform, heavy ground and climatic conditions of their operation require a systematic approach to assessing their qualities. The quality assessment of the entire variety of special cross-country vehicles was carried out according to their design parameters and operational properties.

The safety of the movement of these machines is largely related to their longitudinal and transverse stability. It is known that about 15% of all road accidents in our country are cases of overturning cars while driving on public roads.

Special cross-country tracked vehicles are designed for driving mainly off-road, heavily waterlogged and rough terrain, deep snow cover, terrain with significant slopes. In this regard, one of the main operational indicators of the patency of these machines is stability, which characterizes the ability of the machine to work in off-road conditions on longitudinal and transverse slopes without tipping over. This operational property ensures the safety of the crew,

passengers and the safety of the transported cargo. The stability of the car is called its property to maintain the direction of movement, to resist overturning and transverse sliding. There are longitudinal and transverse stability. This paper reflects the relevance of theoretical and experimental evaluation of the longitudinal and transverse stability of cross-country vehicles designed for use in extreme off-road conditions. The material of the article contains the main aspects of theoretical and experimental determination of stability angles and coordinates of the center of mass of the machine. The technique of assessing the stability of the machine was used when testing an experimental sample of a transport and technological machine.

It should be noted that a number of issues of ensuring the stability of cross-country vehicles, especially articulated ones, require further theoretical and experimental research.

Longitudinal stability. When driving on the rise, overturning occurs when the front support rollers or wheels of the car are completely unloaded. The entire weight of the car is perceived by the rear support rollers or wheels. In this case, the rollover is mainly determined by the coordinates of the center of gravity of the machine and the distance between the axes of the tracks or wheels. When the car is moving forward, its longitudinal stability decreases under the action of the moment of resistance to movement. Many existing models of cross-country tracked vehicles can operate on slopes with a steepness of up to 35 °, in areas with smooth microrelief and at a limited speed.

Lateral stability. The loss of lateral stability by the machine is more likely and dangerous. The lateral stability of vehicles and special machines is one of the most important safety indicators, the assessment of which is given great importance.

When the car is parked on a transverse slope, one of the sides is unloaded. When one of the sides is fully unloaded, tipping occurs, which largely depends, for example, on the track width and the vertical coordinate of the center of gravity. Causes of occurrence overturning can be: the surface of the road (support surface), a lateral slope exceeding the permissible one; deviation of the car from straight-

line movement, which may be caused by a transverse (lateral) force applied to the tracks or wheels; (lateral forces may be caused by single obstacles), waterlogged ground (when driving off-road) and other external reasons. Consequently, in addition to longitudinal traction or braking forces, lateral forces can also act on the car when moving. The lateral stability of wheeled and tracked vehicles is characterized by the values of the limiting angles at which the vehicles can stand without tipping over.

In the process of creating special tracked vehicles of increased cross-country capability, methods of experimental determination of the coordinates of the center of gravity and stability assessment have been developed and the methodology that was used to test the machines has been formalized.

Method of experimental determination of static stability angles. To determine the angle of longitudinal or transverse (depending on the orientation of the machine on the platform) stability, the crane lifting drive is activated to tilt the platform with the machine relative to the axis of the platform rollover. The angle of inclination of the platform, at which there was a separation from the support surface of at least part of the track belt, is the angle of stability for this condition and orientation of the machine. The moment of separation of the track belt from the supporting surface of the platform is fixed visually, and the angle of inclination of the platform at separation - according to the direction of the goniometer installed on the platform. If the center of gravity of the machine does not lie in a vertical plane passing through the longitudinal axis of the machine, the angle of lateral stability should be determined when the machine is tilted towards the working area, for example, a manipulator. With the help of this technique, it is possible to assess the stability of the machine depending on the angle of the front and rear parts of the chassis. The results of determining the static stability angles are recorded in the test report.

The method of determining the center of gravity. The longitudinal and transverse coordinates of the center of gravity of the machine are determined by

the method of axial and side-by-side weighing on automobile scales of the corresponding load capacity.

Recommendations for improving the stability of the machine. Recommendations for improving the stability of the machine are developed based on the materials of testing machines and studying information in the press. According to the results of operational tests of the machines, various support rollers and tracks were developed and tested. Based on this, the most rational parameters of the rollers (diameter, width, tread shape, roller material, geometry and design) and tracks (width, configuration and material) were established, providing increased stability and patency of machines and reducing the transverse sliding of machines on slopes. Outriggers were used in some cars to ensure their stability in off-road conditions and slopes. The number of outriggers ranged from 2 to 4, depending on the purpose of the machine. The kinematics and design of outriggers ensured their functioning within the machine's overall width or beyond the overall size.

A number of design solutions, including kinematics, geometric parameters and material of outriggers, rollers and tracks are being considered for patenting applications.

1. One of the effective ways to increase the stability of the machine both longitudinally and transversely is to lower its center of gravity and reduce ground clearance as a result of the use of more advanced design solutions, rational layout of technological equipment, optimal placement of cargo during operation.

2. Increasing the stability of the machine can be achieved through the use of a rational chassis layout (2-, 4-tracked), the use of more advanced technical solutions of running systems and their interconnection.

3. When determining the critical lifting angle, it must be taken into account that the traction force on the hook has a great influence on the stability of the machine.

4. Increasing the lateral stability of the machine when working on slopes and reducing the transverse sliding of machines can be achieved through the use of a

special design of support rollers and tracks of a special configuration, including asymmetric ones.

5. The transverse sliding of the machine on slopes can be reduced due to: the use of special configuration tracks and additional ground hooks located mainly at an angle of 90 ° to the longitudinal axis of the tracks; optimal increase in the track of the machine.

6. Increasing the transverse stability of the machine when working on waterlogged soils and with deep snow cover can be achieved by: optimal increase in the track of the machine; the use of outriggers of special kinematics and design, taking into account their use in off-road conditions and deep snow cover; transfer, for example, a manipulator, a working body when operating the machine in the opposite direction from rollovers.

7. A roll meter with light and sound alarms should be installed in the cab, warning the driver about the maximum angle of inclination of the machine. The roll meter can be integrated into the control system.

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