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«Research of influence of the operational and constructive factors of the measuring equipment on quality of diagnosing automobile system»

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Abstract of dissertation for the academic degree M.Sc.

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Relevance of work

Improved diagnosis of cars, largely depends on the accuracy and reliability of diagnosis. To achieve a high diagnostic outcome, especially, should make an exception error diagnosis. Errors diagnosis (1 st and 2 nd kind) leads to a linear failure and accidents or unnecessary cost for repair and adjustment.

The analysis showed that the correct wheel geometry ensures the implementation of high performance properties of cars. According OLD MADI 45-60% of cars in operation with a deviation from the norm convergence of the front wheels, while the deviation from noma of 1 mm gives a 3-4% fuel consumption, and in the middle cars with broken wheels geometry fuel consumption by 10-20%. In addition, the geometry of the wheels greatly affect the active safety, tire wear and emissions of harmful substances into the atmosphere.

On the other hand analysis of the current state of organization, technology and equipment positions the diagnosis of wheel geometry shows that not all service stations, providing quality services, ensuring control and regulation of diagnostic parameters with the required accuracy. Metrological characteristics of equipment for measuring the angles of the wheels are not supported at the required level, indeed much of the SRT did not provided with means for adjustment and verification of stands. You can also say that the technology of diagnostic work does not always meet the requirements of regulatory documents are often not carried out important operations to ensure accurate and reliable measurement of diagnostic parameters. Given the impact angle of the wheels on the operating characteristics of the car and the high cost of labor and material resources in carrying out maintenance work performed on the basis of diagnostic information, it becomes apparent the relevance of research in this area.

The study - Evaluation of the impact of operational and structural factors, diagnostic system for diagnosing the quality of the geometry of the wheels of the car.

Objects of research - diagnostic system of wheel geometry, means of diagnosis, the object of diagnosis, the algorithm of performance.

The working hypothesis - External factors caused by construction equipment and diagnostic technology works in real conditions change, and their variations can greatly influence the quality of diagnosis.

In this regard, it was assumed that by examining the impact of operational and structural factors on indicators of quality of diagnosis, we can identify the most important of them, and improve the quality of diagnosis as a service by controlling these factors.

Research objectives:

1. A comparative analysis of equipment for measuring the angles of the wheels and to identify the most important characteristics.
2. Identify the major indicators of the quality of diagnosis and methods for their quantitative evaluation.

3. The system for the formation of the errors in measuring the parameters of the wheels of the car.
4. Rate-quality diagnosis at different levels of the organization works, equipment, technology and staff development.

Methods:
- Analysis of a priori information;
- Active and passive experiment to determine the level and impact of factors on indicators of quality of diagnosis;
- Statistical data processing and analysis of experimental data, analytical modeling.

Testing results of the study: Key provisions of the thesis discussed at the scientific-technical conference and published in the article "Evaluation of measurement error in diagnosing the geometry of the wheels. Materials IX of the Republican scientific-technical conference of students, undergraduates, postgraduates and young scientists "Creativity young - the innovative development of Kazakhstan." East Kazakhstan State Technical University. Serikbaev, 2009. - Part II. - Pp. 125-128.

The structure and volume of work: The thesis consists of an introduction, main part of the settlement and, conclusion, bibliography. The paper contains 29 figures and 12 tables.

In the first chapter of the dissertation study is examining the equipment for diagnosing the geometry of the wheels of cars.

Diagnostic equipment is one of the important factors on which depend the results of diagnosis. The most important indicators of the quality of diagnosis is accurate, the reliability of result and time of diagnosis.

Based on the peculiarities of the diagnosis as the rendering of service, we can formulate indicators characterizing the quality of the process of diagnosis. Select the most important of them.

To achieve a high diagnostic outcome, especially, should make an exception error diagnosis. Errors diagnosis (1 st and 2 nd kind) lead to a reduction of performance indicators: increased fuel consumption, tire wear, line failures and traffic accidents, or unnecessary cost of repair and adjustment. The main cause of errors and low reliability of the diagnosis - high measurement error caused by various factors.

Another important factor in improving the quality of diagnosis is to reduce vehicle idle time in office diagnosis ie duration of diagnosis. Another important factor in the quality of diagnosis is the fullness of technical diagnosis. According to GOST 20911-89 and the cost of "live" work of diagnosis.

In this paper a comparative analysis is used at the moment stands for diagnosing angles of the wheels of cars. This analysis showed that the infrared and three-dimensional computer displays stands largely superior to other versions of

equipment for diagnosing the angles of the wheels. The main advantages of infrared computer stands as follows: the use of infrared rays instead of cord can significantly improve the accuracy and convenience of measurements, infrared-sensors, DSP 508 can measure convergence with an accuracy of 1 '. Digital processing of sensor convergence ensures greater reliability and stability of the testimony that at least ensures careful handling of requests for system calibration. An example of such a stand can serve as a stand: *Hunter 511* from the infrared measurement system.

Even more interesting is the equipment booth *Hunter S 811 DPS 600* with photocells and cameras. It differs in that the rims on the test car is not fixed the units with sensors, and reflective screens target marked on their labels. The human factor at work on this stand is minimized. DSP600 sensors have a number of indisputable advantages over conventional sensors. The target consists of only the shell and the plate, which makes it much easier. In the case of random mechanical forces on the sensors - the target of damage is unlikely in view absent electronics and moving parts in them.

One of the important tasks of the work was to study the influence of various factors (operational and structural) on the accuracy of measurements of diagnostic parameters and the accuracy of the controlled installation in operation parameters. From the literature [3] it is known that the accuracy of measurements characterizes the degree of approximation of measurement results to the actual value of the measured value. Accuracy estimate the magnitude of error. The smaller the error, the more accurate measurements.

Defining error. Depending on the characteristics of the measured value to determine the permissible random error of measurement using different methods. The most effective method is the method of determining the mean square error (experimental standard deviation of the mean value [3]).

$$S_{a_i} = \sqrt{\frac{\Delta a_1^2 + \Delta a_2^2 + \cdots + \Delta a_n^2}{n-1}} = \sqrt{\frac{\sum \Delta a_i^2}{n-1}} \qquad (1)$$

Here, n - number of measured values;

Δa_i - absolute error of individual measurements.

The paper discusses in more detail the factors that cause the error in measuring the angles of the wheels.

Effect of uneven ground and distortions platform lifts on measurement error angles of the wheels.

To study the effect of uneven ground and distortions platform lifts on the error angles of the wheels, was conducted full-scale experiments. The study was recruited statistics uneven grounds and distortions platform at service stations of the city of Ust-Kamenogorsk.

This statistic shows that the horizontal surface areas, which are produced by adjusting the work is far from perfect. The maximum deviation of the level of one side of the track relative to the other was 14 mm. And most "flat" market comes at a difference of 3 mm. The same trend is with tilting platforms, the maximum difference was 9 mm and a minimum of 3 mm.

Based on studies performed found that the ground roughness and skewness platform lifts provide a significant error in the measurements of angles of wheel geometry. Namely, 0,580 and 0,370 of error in measuring the angle of the collapse at the sites and platforms, lifts with a maximum warp. And the 0,280 and 0,180 errors in measuring the angle of inclination of the longitudinal kingpin with a maximum roughness of platforms and platform lifts, respectively.

Effect beats discs on the error in measuring the angle of the collapse of the wheels.

Checking beats made directly to the car (you can also make it to the balancing test), a measuring instrument - LED clock type on a magnetic stand.

After calculations, we found that the standard deviation arising in measuring the angle of the collapse of the disk which has been beating, is 0,4 mm, or 0,070. After processing the statistics beats drive the wheels, it was found that the influence of beats rim causing the error in diagnosing the angles of the wheels at 0,260 at the maximum beating disc 1,5 mm.

Effect of uneven tire pressure on the measurement error is the angle of the collapse of the wheel and angle of longitudinal inclination kingpin.

As is known, unevenly adjusted tire pressure affects the measurement angles of camber and kingpin. Since the uneven pressure changes the ground clearance (clearance) of the car. To install the modified clearance at different pressures in the tires was made full-scale experiments and analysis of the impact of changes in pressure in the tires and ground clearance vehicles on the results of diagnosis. Also, an analysis of variation of pressure in the tires in actual use of automobiles. This analysis showed that approximately 50% of cars are operated with nedokachennymi tires on 0,1-0,2 kg/cm2.

The value of total error of the above factors was 0.1640 in measuring the angle of the collapse and 0.0760 in measuring the angle of inclination of the longitudinal kingpin

The study was also analyzed the influence of calibration devices on the measurement error.

Analysis of the availability of calibration devices. Calibration device is a tool for monitoring efficiency and accuracy of the instrument. Simulator chassis allows the consumer to self-calibrate the device and control its accuracy.

In order to study the availability of calibration devices, we have surveyed 12 service stations equipped with computer stands diagnosing wheel geometry of the city of Ust-Kamenogorsk. Statistics recruited on the basis of studies of such stations as: Shell, Toyota Center East, Altai service Bipek, 22 inches, Barys, and other service stations. The presence of these devices was observed only at 5 stations. The presence of calibration devices at service stations is not talking only

about the quality of operations, but also the integrity of the owner of the station. Since the acquisition of calibration devices are not always observed when buying themselves stands geometry of the wheels. In some cases, the gauges are a complete set of stands, and sometimes the owners of the stations do not consider it necessary to purchase these devices.

The influence of measurement error on the economic costs in the operation of automobiles.

The study examined the error in diagnosing the geometry of the wheels, and the reasons for their cause. The most common errors are given in Table 1. I must say that depending on the combination and level of organization diagnosis service stations, they are changing. From an economic point of view, it looks at car with costly modern equipment and high level of organization diagnosis, cost of services will be much higher. This can be explained by the fact that at a low level of organization of about 10% of cars are considered to be serviceable, not as such in reality (errors 1 st and 2 nd kind) as a result of this work on the diagnosis performed with low-quality work, low accuracy and unreliable results . And the equipment used at the station with a high level of diagnostic avoids these errors and improve the accuracy and reliability of the results.

Table 1 - Assessment of errors in measuring the parameters of convergence, camber and king pin for different levels of organization of diagnostic work

Types of errors	value error (S)		
	Levels of organization diagnosis		
	Low	Medium	High
Structural factors			
Inherent in the design of the stand (passport)	Stand PC-04 $\alpha - 0{,}125^0$ $\gamma - 0{,}125^0$ $\tau - 0{,}150^0$	Stand Laser $\alpha - 0{,}042^0$ $\gamma - 0{,}042^0$ $\tau - 0{,}050^0$	Stand DPS 600 $\alpha - 0{,}01^0$ $\gamma - 0{,}015^0$ $\tau - 0{,}025^0$
Quality verification, alignment	no gauges $\alpha - 0{,}25^0$ $\gamma - 0{,}25^0$ $\tau - 0{,}25^0$	not certified gauges $\alpha - 0{,}10^0$ $\gamma - 0{,}10^0$ $\tau - 0{,}10^0$	factory gauges $\alpha - 0^0$ $\gamma - 0^0$ $\tau - 0^0$
The distorted area, lift	$\alpha - 0{,}1*10^{-5}$ $\gamma - 0{,}13^0$ $\tau - 0{,}06^0$	$\alpha - 0{,}05*10^{-5}$ $\gamma - 0{,}05^0$ $\tau - 0{,}025^0$	$\alpha - 0{,}1*10^{-6}$ $\gamma - 0{,}025^0$ $\tau - 0{,}012^0$
Factors arising from the technology skills of the operator			
Other tire pressure	$\alpha - 0{,}5*10^{-6}$ $\gamma - 0{,}04^0$ $\tau - 0{,}026^0$	$\alpha - 0^0$ $\gamma - 0{,}2^0$ $\tau - 0{,}013^0$	$\alpha - 0^0$ $\gamma - 0{,}005^0$ $\tau - 0{,}006^0$
Beating wheel disc	$\alpha - 0{,}07^0$ $\gamma - 0{,}07^0$	$\alpha - 0{,}03^0$ $\gamma - 0{,}03^0$	$\alpha - 0^0$ $\gamma - 0^0$
Other (hand brake, improper installation IB, etc.)	$\alpha - 0{,}1^0$ $\gamma - 0{,}1^0$ $\tau - 0{,}1^0$	$\alpha - 0{,}05^0$ $\gamma - 0{,}05^0$ $\tau - 0{,}05^0$	$\alpha - 0{,}03^0$ $\gamma - 0{,}03^0$ $\tau - 0{,}03^0$

Broken angles of the wheels lead to a rapid uneven wear treadmill. The most important is the angle of convergence. Inconsistency in its optimal size dramatically affects the resource tires. The collapse has a noticeable effect on the rate of deterioration with significant deviations from the norm.

Based on the foregoing, we can assume that to get from the bus as possible resource to monitor air pressure and tread wear. Given the regulatory asset tires during normal operation and quality maintenance amount 55000 km, ie 5,5 years. Were identified resource losses when disturbed corners of the wheels. As mentioned earlier, incorrect adjustment of wheel geometry reduces the resource tires by 20%. What does it mean that the same tires at the same annual mileage of 10 thousand km will be used not 5,5 years and 4,4 years. And their share was 44 thousand km This shows that the cost of tires increased by 20%.

After considering all the factors together in an incorrect diagnosis and alignment of wheels, we can say that they greatly affect the safety, durability and efficiency constructive cars.

Conclusions:

In accordance with the purpose of the study were as follows:

1 A comparative analysis of equipment for measuring the angles of the wheels, and identified the most important characteristics.

2 defines the main indicators of the quality of diagnosis and methods for their quantification.

3 The system of formation of defects, identified the most common errors and the reasons for their cause.

4 An assessment of quality indicators for diagnosis of various levels of the organization works, equipment, technology and staff development.

LIST OF MAJOR SOURCES OF INFORMATION

1 Sergeev AG Metrological support of road transport. - Moscow: Transport, 1988 - 247 pp.

2 Grishkevich AI "Cars": Theory. - M.: Higher school, 1986-208 pp.

3 Guide to the Expression of Uncertainty izmereniya. / Translated from English, edited by VA Slaev. - GP VNIIM. DI Mendeleev, St. - Petersburg, 1999 - 126 pp.

4 Karbanovich II "Saving fuel and lubricants for road transport" (experience of the Ministry of Road Transport of the BSSR), Minsk: BelNIINTI, 1980 - 41 pp.

5 Kompantsev VI "Development of operational management system fuel vehicles in operation. Diss. kand. Tekhn. Sciences - Moscow, 1982, 235 pp.

6 Nazarov NG "Metrology". Basic concepts and mathematical models. M.: Higher School, 2002 - 348 pp.

7 Tartanovsky DF, Hawks AS "Metrology, standardization and technical means of measurement": Textbook for universities. - M.: Higher School, 2001.

8 "Technical operation of vehicles: Textbook for Universities / Edited ¬ s ES Kuznetsov - Moscow: Transport, 1991 .- 413 pp.

9 Parkhomenko AT "Technical diagnostics. MS Mechanical Engineering. 1986.

10 GOST 8.010-99 GOS. "Methods of measurement. The main provisions.

11 RMG 29-99. GOS. "Metrology. Basic terms and definitions.

PUBLICATIONS

1 Losevskoy DN, Zavalko AG "Evaluation of measurement error in diagnosing the geometry of the wheels. Materials IX of the Republican scientific-technical conference of students, undergraduates, postgraduates and young scientists "Creativity young - the innovative development of Kazakhstan." East Kazakhstan State Technical University. Serikbaev, 2009. - Part II. - Pp. 125-128.