

Summary

This dissertation deals with the problem of car adaptation devices for people with motor dysfunctions. In most cases, these are devices that replace the brake pedal and the accelerator pedal. They are usually in the form of a lever placed horizontally under the steering wheel or vertically next to the driver's seat. The work examines the most common design solutions among devices found on the European market. Their widely discussed advantages and disadvantages were also noted. The scientific literature on the construction and use of this type of adaptive devices was also analyzed. In addition, the legal acts that regulate the use of devices, their assembly, as well as technical requirements were analyzed.

Based on the analysis of legal documents, scientific literature and the existing construction solutions, the author of the dissertation noticed that there are significant deficiencies in the legal provisions concerning the specific requirements for adaptive devices for people with disabilities. There are no guidelines to ensure their proper operation under all conditions.

At the same time, on the basis of the analysis of the existing constructions of adaptive devices replacing the working brake, the author of the work noticed a potential problem in the operation of this type of devices. To activate the car's brake, it is necessary to apply pressure to the brake pedal. To make the intensity braking (measured by the braking efficiency index) be on sufficient level (as defined in the regulations), a certain amount of pressure force is needed. The value of this force depends on the design of the braking system. Installing an adapting device in a car introduces some changes (mechanical ratio) to the required force on the brake lever.

Persons with disabilities may be limited in their ability to apply pressure to the brake lever. Thus, it may turn out that they are not able to cause the braking process with a sufficient value of the braking efficiency index. Therefore, the purpose of this dissertation was to test this problem.

A series of empirical studies were carried out on five cars equipped with various adaptive devices. Based on the conducted experiments, the characteristics of the braking system were determined in the form of a dependence of the braking efficiency index on the force applied to the operating brake lever. Then a second series of studies was carried out with the participation of people with motor dysfunctions. As a result of these experiments, the characteristics of the pressure they generate on the brake lever were determined depending on the position of the driver's seat.

During the analysis of the research results, in addition to the statistical analysis, a comparative analysis was used. For this purpose, the characteristics of the braking systems of individual cars (modified for people with disabilities) were compared with the characteristics of the pressure force generated by drivers with motor dysfunctions. As a result, it was possible to evaluate individual adaptation devices and their adaptation to both individual cars and individual drivers.

The results of the analysis are presented not only in a visual form, but an analytical version of the relationships studied was developed. In this way, a mathematical model was created that describes the studied dependencies in a parametric manner.

The conclusions of the work concern the methodic of selecting the design parameters of adaptive devices. Special attention was paid to the necessity of individual selection of devices

adapting the car braking system to the needs of people with motor dysfunctions. The process of selecting devices should take into account both the performance parameters of the braking system present in the vehicle, as well as the biomechanical parameters of the person with a disability for whom the given adaptation is being developed.