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Determination of up-to-date directions of development of domestic system of testing and certification of railways rolling stock



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Abstract

In the paper, researches results of development of system of tests devoted to up-to-date directions determination and certification of rolling stock and its components are provided. Necessity of synchronization of diagrams and domestic standards of test and certification activities in the field of rolling stock with European legislation is proved. Results and features of the experience analysis of appropriate types of activity of the European countries advanced enterprises are provided.

Key words: RAILWAY TRANSPORT, ROLLING STOCK, EUROPEAN INTEGRATION, DEVELOPMENT OF TESTS AND CERTIFICATION, CRASH-TEST

Problem statement

In recent years, increasing in need for transportations including the railways is observed due to integration of Ukraine into the international economic space. To satisfy the growing demand, and also to increase the attraction of the created transport corridors including transit, passing across the territory of the country ones, it is necessary to increase productivity of the transportation process by highly effective methods [1-5] performed in a railway system considering the necessary level of economy of area in general.

Operation of outmoded low dynamic rolling stock, which share is 90% in the railroads, is one of the reasons of insufficient level of traffic safety of the trains and high operating expenses caused by increase in expenses for repair work, and also the raised energy consumption for hauling operations. New requirements, which lead to increase in level of forces of dynamic interaction of rolling stock and rail track, are applied, which is inadmissible under the conditions of considerable wearing of carriage part of most advanced rolling stock [6-11].

The national-level program of adaptation of the legislation of Ukraine to the legislation of the Council of Europe approved by the Law of Ukraine No. 1629-IV of 18.03.2004 determines the regulatory framework regulating activities of a rail transport by the priority direction of adaptation. At the same time, one of the most important problems is the problem of safety in operation and renewal of rolling stock of

Ukrainian railway. Therefore, “The technical regulation of safety of rolling stock of rail transport” No. 1194 of December 30, 2015 was approved by the resolution of Cabinet Council of Ukraine; it determines the main requirements to rolling stock, which is produced and upgraded, and also to its components and spare parts when designing, production, installation, adjustment, setting into operation, operation, repairing [12-18].

It is specified by the technical regulation that components of technical supply of safety of rolling stock of rail transport is designing, production, upgrading, installation, adjustment, setting into operation and repairing of rolling stock of rail transport.

Now, introduction of technical regulations of railway transport, interstate and international standards with safety requirements to the rolling stock and infrastructures and to estimation of compliance for the purpose of active participation in international transport and preservation of transit capacity of the state acquires relevance in Ukraine.

Analysis of the last researches and publications

The analysis of existing test centers (Fig. 1, Fig. 2) responsible for certification and setting railway rolling stock into operation shows that in our country there is no center which would have own testing ground and carry out testing for passive safety (crash-tests) according to DIN EN 15227-2011.

The objective of paper is scientific justification of necessity of synchronization of diagrams and testing procedure and certification of the domestic rolling stock

with the European legislation on the basis of analysis results of appropriate experience of the European countries, and also determination of features of these measures implementation.



Figure 1. Testing ground Siemens



Figure 2. Testing ground Test Centre VUZ Velim

Statement of the basic material of research

At present time, the following directions in the field of scientific research, design developments and practical works on renewal of the rolling stock are considered as priority:

- to concentrate attention on creation of the new rolling stock;
- to calculate the expected reduction of operating expenses, to provide improvement of ecological and ergonomic qualities, increase in service live in case of creation of all types of rolling stock;
- to develop and introduce new technical solutions in a design of the rolling stock in general and bogies in particular for ensuring reduction of dynamic impact on path;
- to ensure safety of the movement at high speeds along the line.

The above-mentioned priority directions are:

1. To keep creation of new and modernized rolling stock for the railways of Ukraine in strict accordance with requirements of national regulating documents for procedures of development, testing, receipt and delivery of technical products to the production line.

2. PJSC “Ukrainian Railways” together with the industry scientific organizations should consider a problem of creation of the testing ground taking into account the modern requirements applied to rolling stock and railway infrastructure.

3. Gradual scheduled transition to service of the rolling stock taking into account the actual technical condition must become priority; to increase efforts on improvement and development of new technical solutions on identification and forecast of technical condition, creation of complex systems of local and remote control and technical diagnostics of details, knots and units of carriages and locomotives.

4. For the enterprises and organizations connected with designing, production, research, operation and repair of railway rolling stock:

- to use more progressive experience and advanced achievements of not only the enterprises of Ukraine, but also foreign countries (Fig. 3, Fig. 4);
- to develop native experimental base with the use of modern computing tools;
- to pay special attention to development and creation of advanced rolling stock including the way of modernization of existing one with the use of energy-saving technologies and alternative fuel types;
- to introduce progressive methods, technologies and diagnostic methods of rolling stock with a possibility of transmission of diagnosed data through cellular network; these methods allow reduction of expenses on its servicing and repair [6-13].

The behavior of vehicle is studied by the result of action of longitudinal dynamic loads by means of numerical modeling.

The result allows organizing the effective device of energy absorption in a design of rolling stock. Plastic and elastic devices absorb impact energy. In Fig. 5, the example of rolling stock clash at the railway crossing according to DIN EN 15227: 2008 is shown.

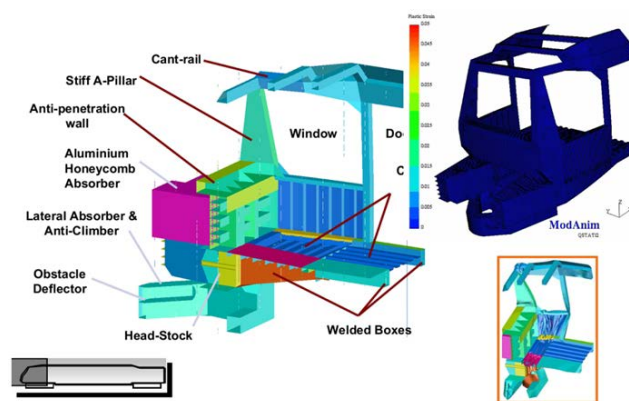


Figure 3. Computer modeling of the rolling stock



Figure 4. The locomotive model for carrying out a crash test



Figure 5. Clash of the rolling stock at railway crossing

Safety of the locomotive driver and passengers can be also optimized by means of numerical modeling and practical tests with human models. Interaction between interior objects of passenger carriages and passengers in case of clash is determined by means of computer modeling on human models (Fig. 6, Fig. 7). Special program developments allow designing systems of control.



Figure 6. Train Interior Passive Safety – before testing



Figure 7. Train Interior Passive Safety – after testing

Mentioned data show expediency of creation of special grounds for check of passive safety of the rolling stock of railway. At the same time, development of such direction requires development of corresponding methods and techniques, mathematical, computer and physical models.

Conclusions and suggestions

As a result of conducted research, it has been established that one of priority tasks in case of European integration of domestic railway transport complex is synchronization of schemes and order of its testing and certification of rolling stock with the European legislation. At the same time, an important component of successful implementation of such direction is development of adapted systems of crash tests of carriages, locomotives, multiple unit, etc.

The aforesaid proves expediency of carrying out of scientific-research and development works on creation of theoretical theses, methodological bases and practical means of tests and certification of rolling stock which will pass the standards of the European Union.

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