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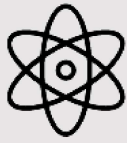
**Proceedings of the 8th
International Scientific
and Practical Conference**

**SCIENTIFIC HORIZON IN THE
CONTEXT OF SOCIAL CRISES**



TOKYO, JAPAN

11-12.04.2021



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This issue of Scientific Collection «InterConf» contains the International Scientific and Practical Conference. The conference provides an interdisciplinary forum for researchers, practitioners and scholars to present and discuss the most recent innovations and developments in modern science. The aim of conference is to enable academics, researchers, practitioners and college students to publish their research findings, ideas, developments, and innovations.






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GENERAL ENGINEERING AND MECHANICS

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IMPROVING TO A PASSENGER CAR BODY TO ENSURE RELIABILITY OF ITS FASTENING ON A RAILWAY FERRY

Increased competitiveness of passenger rail traffic led to putting into operation of rail ferry services [1, 2]. A feature of such transportation is the ability of wagons carriage by sea on special ships - railway ferries. Formerly, passenger cars were loaded on the deck by transferring them from the track of the ferry complex to the ferry tracks with hoisting devices. And now the cars are loaded on the train ferry by rolling over the passing (loading) ramp, which has considerably shortened the loading/unloading operations.

Recently train ferries have been equipped with special fastening brackets for passenger car bodies. Each body is fixed with six brackets (three at each side).

The cars are fixed relative to the deck according to a standard scheme with chain binders equipped with turnbuckles and stop-jacks. In order to avoid the rocking of cars on the rails, brake stops are mounted under the rolling surfaces of the wheels, and the end cars in batches are linked with buffer stops equipped with standard SA-3 couplers along the longitudinal direction. Besides, the car braking system is connected to special hoses to supply compressed air for braking the wheel sets [3].

The strength analysis of the passenger car body, taking into account its fastening relative to the deck for the attaching clamp, allowed to conclude that the maximum equivalent stresses are about 350 MPa, that is, exceed the permissible ones.

So to ensure the reliability of fastening of passenger cars on railway ferries, it is important to improve their load-bearing structures.

The authors suggest that the strength of passenger car bodies under train ferry transportation can be provided by mounting fastening units of chain binders on the body bolster beams. The principle of action of the unit was based on the operation of a hydraulic damper, which allowed reducing the value of dynamic loading on the body.

The numerical value of the dynamic loading on the car body relative to the deck in the new fixation scheme was determined with mathematical model.

The technical characteristics of the train ferry and passenger car bodies, as well as hydro meteorological characteristics of the cruising area were taken as the input parameters of the model. The calculations were made for a Mukran-type train ferry operating on the Baltic Sea.

The study established that the maximum accelerations on the car body at the relative bearings to the train ferry body 60° and 120° accounted for about 1.3 m/s^2 .

It should be mentioned that the coefficient of viscous resistance of the working fluid creating viscous resistance between the body and the deck should be within a range of $2 - 4.2 \text{ kN}\cdot\text{s/m}$. Thus, considering the proposed solution, the maximum accelerations on the car body were reduced by 30% in comparison with that in a typical scheme of fixation relative to the deck.

In order to determine the strength of the improved passenger car body the authors conducted the calculation by the finite element method in CosmosWorks Simulation software suite.

The maximum equivalent stresses were in the lining which simulated the unit's support; they accounted for 120 MPa, thus they did not exceed the admissible values [4, 5]. The maximum displacements were fixed in the center sill of the car and accounted for 1.47 mm. The maximum deformations were $1.01 \cdot 10^{-3}$.

The research conducted may contribute to ensuring the required strength of passenger car bodies under train ferry transportation, thus leading to higher operational efficiency of train ferry transportation within the international transportation.

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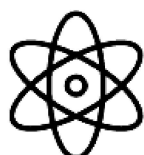
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