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DEVELOPMENT OF A MODERNIZED DESIGN OF A MOTOR CARRIAGE SUBWAY CAR WITH JUSTIFICATION OF THE STRENGTH PARAMETERS

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ABSTRACT

The article presents the development of a modernized design of a motor carriage subway car with a justification of the dynamic and strength parameters, numerical studies were carried out in the programming environment MATHCAD 15. In connection with the massive failure of subway cars for Uzbekistan Temir Yollari JSC, it is necessary to develop a new way to modernize the motorcar rolling stock trolley frames for overhaul in order to improve dynamic performance and increase strength and reliability (specifically, for trolleys of a subway car).

In the conditions of business accounting and in connection with the transition to a market economy, one of the most important tasks for the economic and political independence of our Republic is to increase passenger transportation, which entails an increase in the fleet of vehicles, including locomotives, passenger cars and subway cars. In Uzbekistan, there are no factories for the production of subway cars, in connection with this, it is necessary to modernize the cars in operation, which is currently being carried out at the VSRZ (car repair and car building plant) in Tashkent. The article presents the development of a modernized design of a subway car motor-car bogie with a justification of the dynamic and strength parameters, numerical studies were carried out in the MATHCAD 15 programming environment.

According to the data of the Car Operation Department at JSC UTY, a significant number of fatigue cracks have been identified at present, although their repair was carried out in accordance with the instruction CT 336. At the same time, even welded, according to the rules of depot repair, cracks continue to develop and increase in size, weakening the most dangerous sections. It is obvious that the general stress state of the subway car bogie frames will significantly depend on the constantly acting dynamic forces.

In modern literature, the issues of the theory of vibrations and reliability of rolling stock bogie frames, taking into account the optimization of their dynamic characteristics, as well as methods for their rational design and modernization are not sufficiently developed to date [1÷6]. Due to the mass failure of subway cars, JSC Uzbekistan Temir Yollari needs to develop a new method for upgrading the frame of the bogie of a motor-car rolling stock during major repairs in order to improve dynamic characteristics and increase strength and reliability (specifically, for the bogies of a motor-car metro car).

The Tashkent metro lines use cars of the following models: 81-717, 81-714, 81-717.5, 81-714-5. Cars of the 81-717.5 and 81-714.5 models are a modification of cars 81-717 and 81-714.

The frame is the main supporting element of the bogie, which is designed to transfer loads from the body of the metro car to the wheel pairs and their uniform distribution, installation and fastening of units and elements of the bogie. During operation, the bogie frame experiences significant alternating dynamic loads, which can lead to the appearance of fatigue cracks and residual deformations of the frame elements. In addition, wear-resistant bushings are pressed into the brackets of the elastic hinge joint of the levers and the brackets for installing hydraulic dampers, which are subject to wear during operation due to friction processes in the hinge joints of the hydraulic vibration dampers.

The modernized subway car body frame (Figure 1) is made of welded channel-shaped beams. The basic unit of the bogie, on which all the undercarriage equipment is mounted, is a welded H-shaped frame. The frame consists of side chords and two cross beams. The side chords of the frame are a channel 180 mm high with a horizontal shelf width of 70 mm. The chords are made of separate parts (beams), which are butt-welded using electric arc welding. The side chords have oval holes for welding the outer skin of the body walls.

When calculating the bogie frame of a multi-car subway car, it is considered as a spatial rod system, numerical studies were carried out in the programming environment MATHCAD 15.

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