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WHEEL–RAIL INTERACTION FOR A PASSENGER CAR WITH THE ITM-73ER NEW WHEEL PROFILE IN CURVES

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Speeding up the integration of Ukraine into the European railway transportation is an important task in the current development of the Ukrainian railway transport. Currently, the most effective way to travel across borders between countries with different track gauges is the use of gauge-changeable wheelsets. Continuous traffic on the Ukrainian (1520 mm gauge) and European (1435 mm gauge) railways calls not only for gauge changing facilities, but also for the compatibility of the wheel-rail contact pair on both railways: R65 rails and a cant of 1/20 in Ukraine and UIC60 rails and a cant of 1/40 in Europe.

At the Institute of Technical Mechanics of the National Academy of Sciences of Ukraine and the State Space Agency of Ukraine, a new wear-resistant wheel profile, ITM-73ER, was proposed. As predicted, its use in passenger cars will offer dynamic stability and a high dynamic performance throughout the range of operating speeds on the Ukrainian and European railways and acceptable indices of wheel – unworn rail interaction on both railways. In service, the shapes of the wheel and rail contact surfaces change due to wear, especially in curves. Because the Ukrainian and European railways mostly use wheel and rail profiles of their own, the use of the new wheel profile may impair the wheel–rail interaction process, enhance wheel flange wear, and shorten the wheel life.

The goal of this work is to study the effect of the in-service rail head shape change in curves of the Ukrainian and European railways on the wheel–rail interaction indices of a passenger car with ITM-73ER profile wheels.

The head shapes of outer rails of the Ukrainian and European railways' circular curves were predicted for a side flange wear changing from 0 to 8 mm in 2 mm increments. The calculations were made for two circular curves of radius 300 m with UIC60 rails and a cant of 1/40 (Europe) and R65 rails and a cant of 1/20 (Ukraine). To speed up the prediction, it was assumed that the curves were traveled by four-axle fully loaded freight cars, which maximizes the rail wear. The freight car wheels were assumed to be unworn and machined to the S1002 profile (for the European railways) and to the standard profile specified by the Ukrainian State Standard GOST 10791:2016 (for the Ukrainian railways).

Using the computed head shapes of R65 and UIC60 rails differing in wear degree, a study was conducted into their effect on the wheel–rail pair strain and stress field and the dynamic indices of car–track interaction for passenger cars with ITM73-ER profile wheels negotiating a circular curve of radius 300 m. It was shown that the use of the ITM-73ER wheel profile in passenger cars will offer improved indices of car–track interaction, for worn rails too, both on the Ukrainian railways and in the combined operation on the Ukrainian and European railways.

***Keywords*:** *high-speed rail vehicles, wheel profiles, stress and strain field, interaction processes, wheel and rail wear*.

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