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Study of the possibility of using disturbances formed from recorded track irregularities in the calculation of high-speed rail vehicle dynamics

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An urgent task for Ukraine during the post-war reconstruction of the country will be the upgrade of the entire railway transportation system, in particular the development of high-speed passenger traffic. The prediction of the dynamic performance of high-speed rail vehicles calls for the formation of new input arrays (track-induced disturbances) that would account for more stringent track geometry requirements.

The aim of this work is to study the possibility of using track irregularities recorded in real sections of the Ukrainian railways to construct the components of track-induced disturbances acting on a rail vehicle moving at a high speed.

This paper considers in detail standard specifications for the geometric parameters of a track suitable for high-speed traffic. The data are contained in the Standard DSTU EN 13848-5:2018, which is a European standard adopted in Ukraine as a national one by confirmation. Using the track subsidence and alignment irregularities recorded by a track measurement car in a number of sections of the Pryndipovska railway during a scheduled track inspection, processes of actual vertical and horizontal irregularities were formed. The quality of those sections had not require any speed limitation. Irregularity parameters for those sections were calculated. A comparison between the calculated parameters and those specified by the DSTU EN 13848-5:2018 showed that among the sections considered there exist ones that meet the track geometry requirements and allow speeds at least up to 230 km/h. The use of the irregularities in the selected track sections as disturbance components in calculations was tested by the example of determining the ride performance of a standard passenger car with KVZ-TsNII-M trucks. The calculated results showed the possibility of using the generated disturbances in numerical calculations of the dynamic performance of rail vehicles at increased speeds and at the same time confirmed the need for new engineering solutions on the design of rail vehicles capable of operating at such speeds.

: high-speed traffic, track irregularities, normative document, dynamic performance indices.

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