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RESEARCH OF SURFACE CONDITION OF THE RAILS ROLLING ON SECTIONS OF HIGH-SPEED AND HIGH-SPEED TRAIN TRAFFIC

Абдуалиев Э.Б.¹
Abdualiyeв E.B.¹

¹ – Ташкентский институт инженеров железнодорожного транспорта
(Ташкент, Узбекистан)

¹ – Tashkent Institute of Railway Engineers (Tashkent, Uzbekistan)

Abstract: This article analyzes the intensity of impulse irregularities that occur on the surface of the rolling rail heads on the section of high-speed and high-speed train traffic. On the rolling surface of the rail heads, the formation of pulse irregularities is observed, which are fixed by the measuring system of the track measuring car No. 106. This shows the main character of damage to the surface of the rail head ride.

Key words: rails, pulse irregularities (ID), measure, indicator, pilot area.

ИССЛЕДОВАНИЯ СОСТОЯНИЯ ПОВЕРХНОСТИ КАТАНИЯ ГОЛОВОК РЕЛЬСОВ НА УЧАСТКАХ СКОРОСТНОГО И ВЫСОКОСКОРОСТНОГО ДВИЖЕНИЯ ПОЕЗДОВ

Аннотация: В данной статье проведен анализ интенсивности импульсных неровностей, возникающих на поверхности катания головок рельсов на участке скоростного и высокоскоростного движения поездов. На поверхности катания головок рельса наблюдается образование импульсных неровностей, которые фиксируются измерительной системой путевого измерительного вагона № 106. Это показывает основной характер повреждений поверхности катания головки рельса.

Ключевые слова: рельсы, импульсные неровности (ИН), измерения, показатель, опытный участок.

Introductions. Durability of rails, driving comfort and high-speed trains, the rolling stock is largely related to the condition of the running surface of the rail heads. In the course of movement of trains on a surface of rails there are either local, or extended roughnesses (wave-like deformation of rails). According to the accepted classification of rail defects NTD CP-2-93 the most significant are:

- undulating deformation of the rail head (defect 40);
- crumpling and vertical wear of the head (defects 41.1-2);
- lateral wear of the head in excess of the available standards (defect 44).

Undulating wear of the rails (defect 40) causes intense noise, impairs the smoothness of the train and reduces the service life of the elements of the upper structure of the track and the running gear of the rolling stock. It manifests itself as periodic irregularities on the rail head. The occurrence and development of wavy wear are the result of many factors, so there can be no single means to eliminate it. In the presence of initial wave-like defects (on new rails) in the process of dynamic effects during the movement of trains there are further development of the defect, the formation of wave-like irregularities (long waves) with an increase in their amplitude. The wave irregularities on the rail head are essential. Their origin and development are connected both with the technology of production of rails, and with the conditions and nature of their work under moving load [1].

For reliable detection of differently oriented internal defects of rails in the flaw detector several methods of ultrasonic testing are implemented, below are signs of detection of defects and

corresponding channels of continuous control of both rail threads [2]. This article deals with the local irregularities of the surface of the rolling head of the rails arising in the areas of high-speed and high-speed movement of trains of JSC "O'zbekistan Temir Yo'llari". At the same time, the so-called "impulse irregularities" (hereinafter referred to as in) are considered, which are measured and evaluated by the track measuring car No. 106 of the track management Department.

To study the presence, intensity and dynamics of IN accumulation randomly within the Tashkent-Samarkand line.

In accordance with the developed research methodology, at the first stage, the presence and intensity of IN is assessed at the experimental sites. Subsequently, it is planned to study the possible causes of IN, to develop recommendations for their elimination and prevention.

For the initial assessment of the condition of the rail heads in the experimental sections, the results of track measurements by track measuring car No. 106 of March 3, 2019 were used. After that, to assess the condition of the rail heads in the experimental sections, the results of track measurements by the track measuring car No. 106 of September 18, 2019 were used.

The main indicators of the state of the rail heads in the experimental sections by the presence and intensity of IN are presented in table. 1, 2.

Table 1.

The number of pulse irregularities in the experimental area No1. 03.03.2019 year

Km	Number of pulse irregularities							
	Right thread with depth, mm				Left thread with depth, mm			
	to1.0	from 1.0to 2.0	from 2.0to 3.0	more 3.0	to1.0	from 1.0to 2.0	from 2.0to 3.0	more 3.0
3714	0	0	0	0	0	1	0	0
3715	0	0	0	0	1	3	1	0
3716	1	0	0	0	0	2	2	1
3717	0	0	0	0	1	1	0	0
3718	0	0	1	0	0	2	1	1
3719	0	0	0	0	0	0	0	0
3720	0	0	0	0	1	2	0	0
3721	0	0	0	0	0	8	1	0
3722	0	0	0	0	1	2	1	0

Table 2.

The number of pulse irregularities in the experimental area No1. 18.09.2019 year

Km	Number of pulse irregularities							
	Right thread with depth, mm				Left thread with depth, mm			
	to1.0	from 1.0to 2.0	from 2.0to 3.0	more 3.0	to1.0	from 1.0to 2.0	from 2.0to 3.0	more 3.0
3714	0	1	0	0	0	1	1	0
3715	0	1	0	0	0	2	3	1
3716	0	0	1	0	0	2	2	1
3717	0	1	0	0	1	0	1	0
3718	0	0	0	1	0	3	2	2
3719	0	1	0	0	1	1	0	0
3720	0	1	0	0	1	2	0	0
3721	0	1	0	0	0	8	1	0
3722	0	1	0	0	1	2	1	0

For rice. 1, 2 and 3 presents a graphical interpretation of the number of pulse irregularities on the rails of the experimental sections. This it is possible to state that on the left rail thread on all experimental sites the number of impulse roughnesses is more than on the right rail thread.

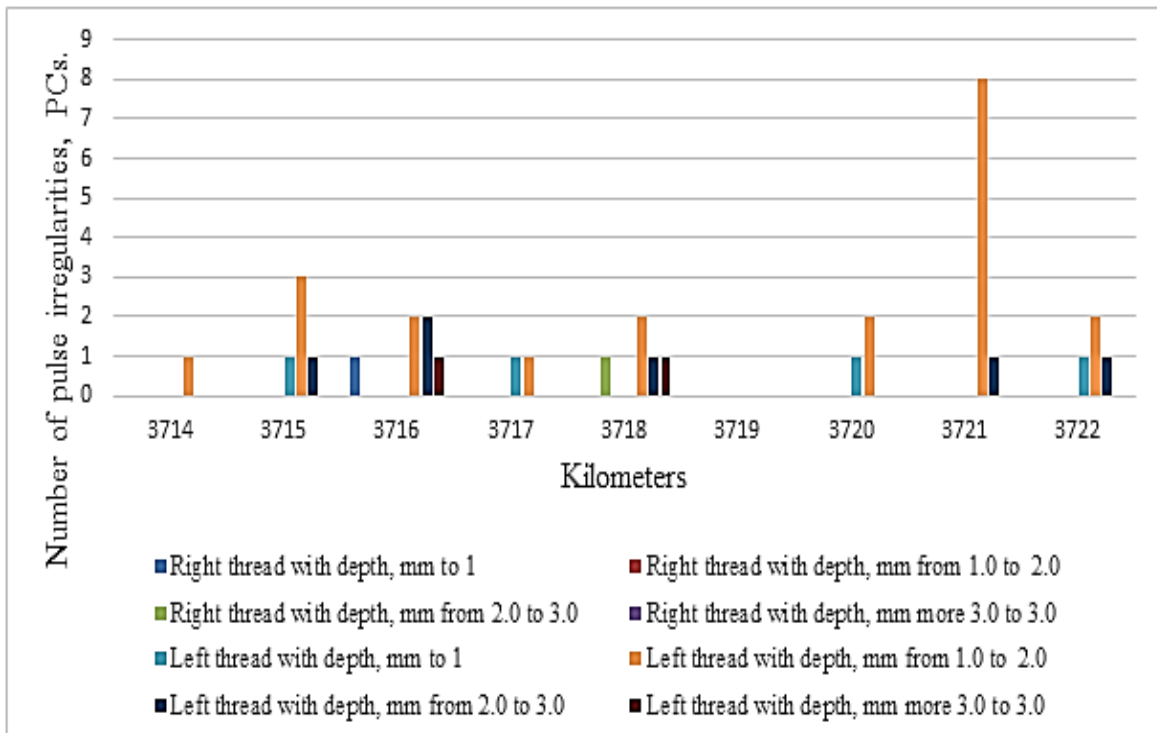


Figure 1. The number of pulse irregularities in the experimental site number 1.

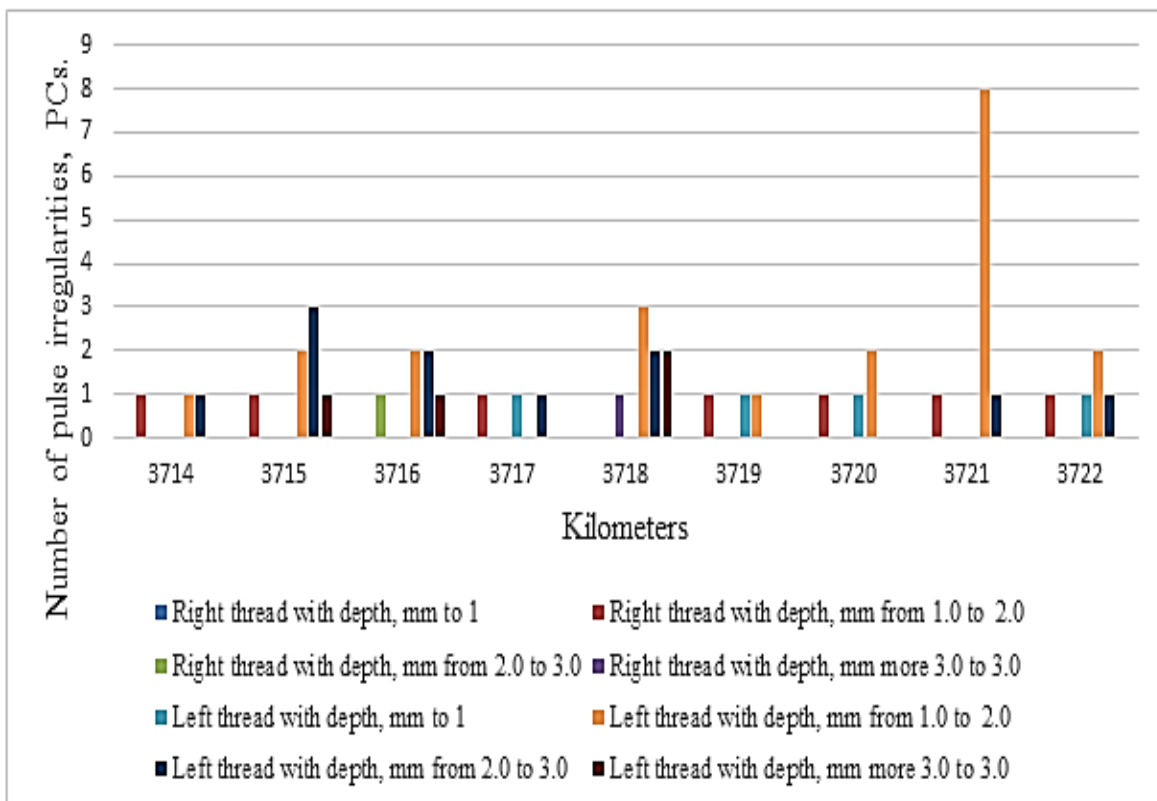


Figure 2. The number of pulse irregularities in the experimental site number 1.

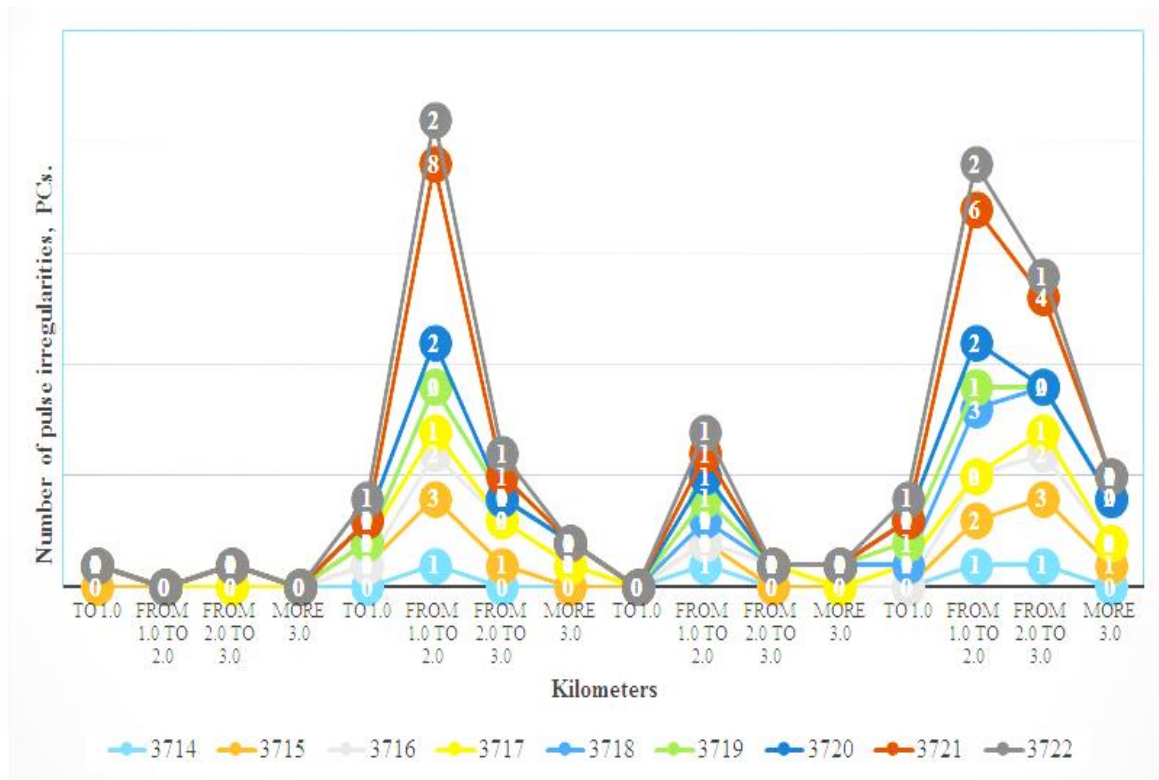


Figure 3. The number of pulse irregularities in the experimental site number 1.

To assess the number and intensity of pulse irregularities within test sites and for analysis of the dynamics of pulse irregularities in the process of operation of rails, a calculated indicator of the state of the rails on pulse irregularities, which is determined by the expression

$$K_{ii} = \frac{\sum n_i * h_i}{L}$$

where n_i -is the number of pulse irregularities within the test area or within the left or right rail threads;

h_i -depth of pulse irregularities;

L -is the length of the test section or rail thread.

The rail condition indicators are shown in table 3. At the same time, it can be noted that the intensity of pulse irregularities for all experimental sections differs significantly for the left and right rails. This fact requires additional study with the analysis of the state of the surface of the rolling rails directly at the full-scale survey of the rails of the experimental sites [3].

Table 3.

Indicator of the state of the rails by the presence of impulse irregularities.

Number of tests at the test site	Rail condition indicator at pilot site No. 1		
	the left rail	right rail	two rails
03.03.2019 year	9,00	0,40	4,70
18.09.2019 year	11,88	2,63	7,26

As follows from tables 1-2 the number and intensity of the manifestation of impulse irregularities associated with the speeds of trains on the experimental site. Despite the lowest missed

tonnage on the rails of the experimental section 1, the intensity of the manifestation of impulse irregularities as of 18.09.2019 significantly exceeds the same indicator for other experimental sites.

Summary.

1. On the surface of the rolling of the rail heads on the sections of high-speed train movement, the formation of nullary irregularities is observed, which are fixed by the measuring system of the track measuring car No. 106.

2. The number and intensity of impulse irregularities are unevenly distributed along the track and negatively affect the condition of the track structure and rolling stock.

3. Conducted detailed surveys of the condition of the rail heads to identify the nature of the damage to the rolling surface of the rail head has been established the development of damage to the rail head doubled impulse irregularities to eliminate it must grind the rail head.

4. After grinding, it is necessary to conduct detailed surveys of the condition of the rail heads on the track of the measuring car No. 106.

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Сведения об авторах / Information about the authors

Абдуалиев Элёрбек Бегали угли- ассистент кафедры «Строительство железных дорог, путь и путевое хозяйство», e-mail: ElyorbekAEB@mail.ru

Abdualiyev Elyorbek Begali o'g'li - assistant of the Department "Construction of Railways, tracks and track facilities", e-mail: ElyorbekAEB@mail.ru