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Visualization of Wheel-Rail Contact Position of Experimental Bogie to reduce Curve Passing Resistance

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Abstract

In this paper, the result of visualization of the contact position between the wheel and the rail when the experimental bogie passes the curve is shown. The change in contact position during the transition process from straight section to curved section and from curved section to straight section became clear. Based on this result, a friction design aimed at reducing the curve passing resistance and noise of the bogie was carried out, and the effect was verified.

Keywords: wheel, rail, contact, curve, resistance, noise.

1 Introduction

Various bogie structures, wheel and rail shapes, control methods and lubrication methods have been developed to make the curve passage of railway vehicles safer and smoother. In recent years, more emphasis has been placed on energy conservation due to demands such as economic efficiency and decarbonization. It is also important that the existing conventional bogie can pass through curves more safely and more energy-saving. In this study, the contact position of experimental bogie when passing through a curve was visualized. In addition, the lubrication design was performed to reduce the curve passing resistance and noise.

2 Methods

The following procedure were performed to reduce the curve passing resistance and noise of the experimental bogie on the track.

1. The contact position of each wheel was visualized using a special paint.
2. Lubrication design was performed in consideration of the contact position and operating environment conditions.
3. The noise when the experimental bogie passed the curve was measured with and without the lubrication design.

3 Results

Visualization of the contact position between wheel and rail when experimental bogie passing a curve was performed. Examples of visualization results are shown in Figures 1 and 2.

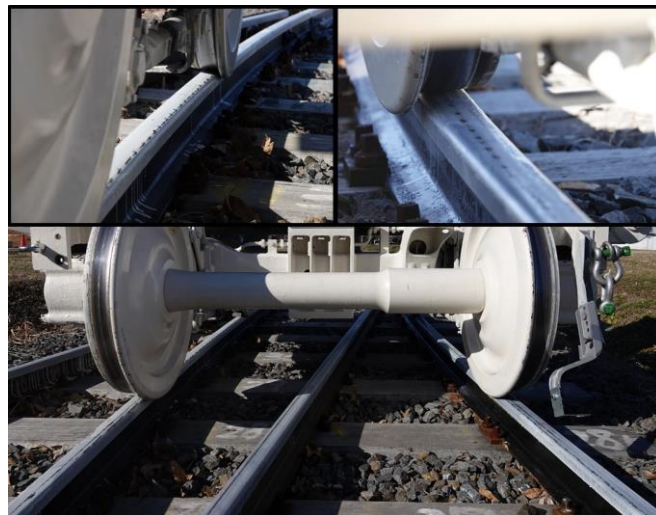


Figure 1: Examples of visualization results on turnout section.



Figure 2: The front wheels and the rear wheels pass through different places.

Lubrication design was performed in consideration of the wheel and rail contact position. The actual working time on the track is about 5 minutes. The noise when the bogie passed the curve was measured with and without the lubrication design. From the spectrograms shown in Figure 3 and Figure 4, it can be seen that the sound outside the region from 86 Hz to 344 Hz was reduced, and the curve passage resistance was also reduced.

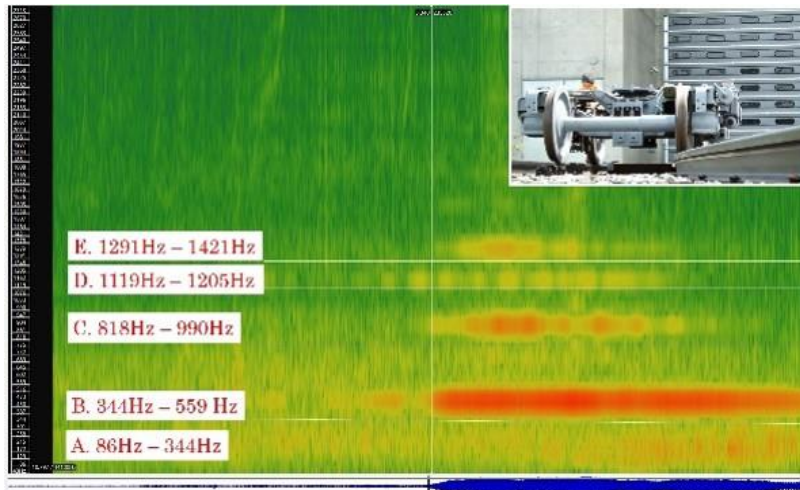


Figure 3: The spectrogram of noise when the experimental bogie passing the R30 class curve without friction design.

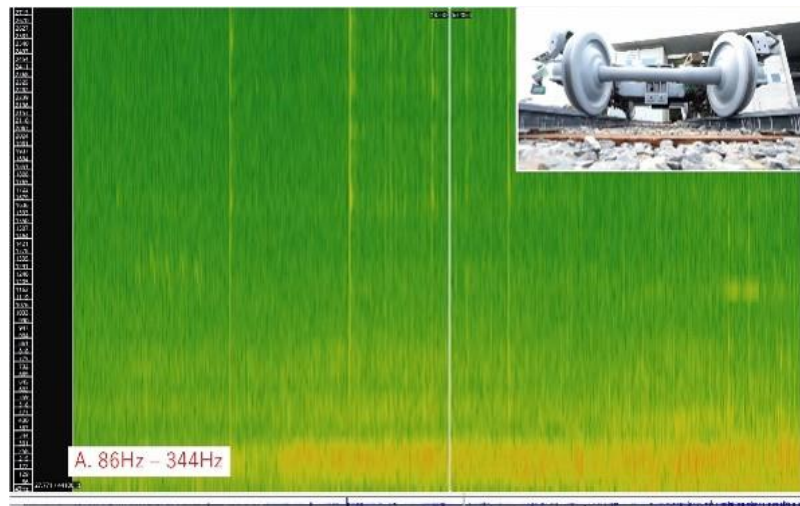


Figure 4: The spectrogram of noise when the experimental bogie passing the R30 class curve with friction design.

4 Conclusions and Contributions

Visualization of the contact position makes it easy to understand the change and movement of the contact position in the process of the experimental bogie passing the curve. In particular, the difference between the front wheel and the rear wheel when passing through a curve is remarkable. In addition, the contact position moving during the transition process from straight section to curve section and from curve section to straight section was also clarified. These are useful for interpreting the difference in running resistance in each section. Furthermore, by clarifying the contact position and range, it became easier to apply the lubrication design, and was possible to reduce the curve passing resistance and noise of the bogie in a short time. These methods and knowledge can be applied not only to bogies that have introduced new technology, but also to many existing bogies and existing lines, and can improve railway safety, low noise, and energy saving.

References

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