Extended Abstract

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Specification Study of Railway Test Track with R33 Curve Section

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The performance demanded for the railway vehicle has changed dramatically as compared to the age when the wheelset appeared. In recent years, high-speed trains have been required for service operations over 300 km/h, whereas LRT (Light Rail Transit) should have smooth curving ability in tight curve section at intersection for left or right turning. In the design of the conventional railway bogie with two solid axle wheelsets, the optimization design method for suspension stiffness and the theory of asymmetric suspension design have been developed. The LRT system attracts attention as the urban traffic system for next generation mobility, because of eco-ability and accessibility. The light rail vehicle (LRV) has independently rotating wheels to achieve low-floor design. However, conventional independently rotating wheels do not have a self-steering ability. In order to obtain self-steering ability with independently rotating wheels, the EEF bogie which makes use of gravity stiffness was proposed. However, this system was not widely used because of complex structure with linkage mechanism in the bogie. The use of independently rotating wheels with inverse tread conicity to achieve self-steering ability without any complex bogie structure was proposed. The effectiveness of the vehicle with two single-axle bogies that use two independently rotating wheels units with inverse tread conicity was proved by 1/10 scale model experiment and full-scale model simulation [1].

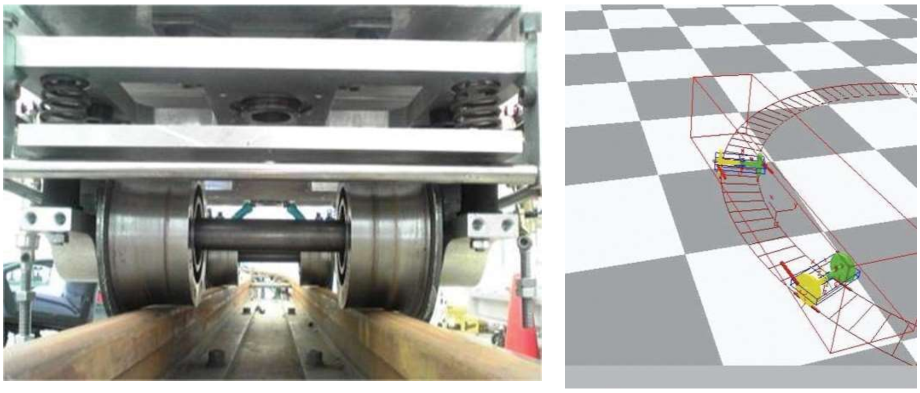

Fig. 1: 1/10 scale model experiment model (left) and full scale model simulation (right)

In order to verify the experiment of the proposed bogie, it is necessary to examine the relation with the gauge widening (slack) existing in the curved section. We investigated the relationship between vehicles and slack using multi-body dynamics simulation in order to carry out a real scale running experiment at Chiba Test Track 2.0 with 33m radius curve section and turnout. In the running simulation, the slack value in the 33m radius curve section were set to 5, 10, 15, 20, 25 and 30 mm. The running velocity of vehicle is 10 km/h. From the simulation results, the wheel flange will ride on the rail when the slack value is 25 mm or more. Based on this result, the slack value in the curve section and turnout section in Chiba Test Track 2.0 is set to 15 mm.

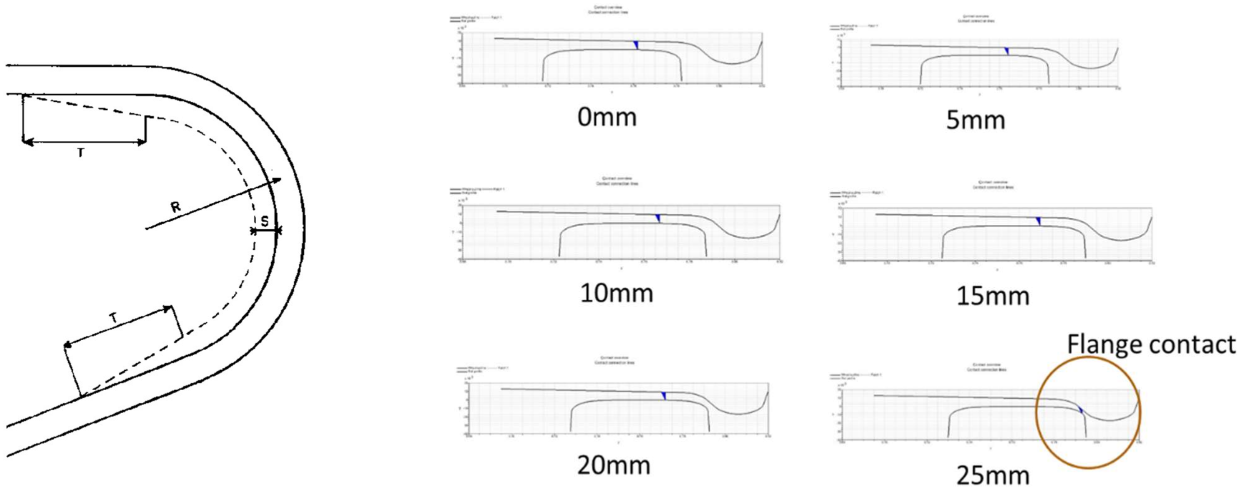

Fig. 2: Slack on the track (left) and full scale model simulation result with different slack value (right)

The research environment on advanced vehicles at Nishi-Chiba was restructured as an ITS R&R experiment field at Kashiwa campus of the University of Tokyo in April 2017. The ITS R&R Experiment Field comprised of proving ground for road, experimental traffic lights, driving simulator and Chiba Test Track 2.0 for railway with R33 curve section, turnout and railroad crossings. We plan to research and verify the vehicle using this Chiba Test Track 2.0.

Fig. 3: Over view of Chiba Test Track 2.0 in ITS R&R Experiment Field

References

[1] Y. Suda , W. Wang , M. Nishina , S. Lin and Y. Michitsuji, "Self-steering ability of the proposed new concept of independently rotating wheels using inverse tread conicity," *Vehicle System Dynamics*, vol.50, pp. 291–302, 2012.