



## Remarks on Special Issue on Railway

*Takuji NAKAI*

General Manager, Head of Div.  
Railway, Automotive & Machinery Parts Technology Div.  
Railway, Automotive & Machinery Parts Unit

*The railway field where high-speed mass transportation is possible and for which the environmental load is low is expected to widely develop throughout the world toward carbon neutrality in the future. The railway system is characteristically more ecologically sound compared with other transportation means; the kinetic energy efficiency of the railway system is overwhelmingly high and the environmental load is very small. For example, CO<sub>2</sub> emissions to be released to transport one person 1 km are 130 g by private automobile, 98 g by air, and 57 g by bus while the emissions are only 17 g by railway. Although Japanese railway services have a history of over 150 years, at first when the operation began, imported steel products were used as railway bogies, wheels, axles, and rails. Nippon Steel Corporation started the domestic production of these steel products and has long been supporting the railway system as infrastructure since then.*

*All of our railway products are critical parts that form the railway system and for which fail-safe design is impossible because if it becomes impossible for such parts, such as wheels and axles, to maintain their functions due to fatigue damage, etc., there are no parts that can back them up. In addition, Nippon Steel started the domestic production of railway bogie frames, which serve as supports between rolling stock and wheels/axles, exactly 100 years ago in 1924 ahead of all others in the industry in Japan. At that time, the bogie frame was an assembly of cast steel, bolts, and rivets. In recent years, most bogie frames consist of plates and seamless steel pipes assembled by welding. Securing the soundness of such welds is a task. Railway companies use rolling stock while securing the safety through nondestructive inspections and other testing during periodic inspections of rolling stock. In addition, the advancement of finite element analysis (FEA) has made it possible to evaluate the reliability of bogie frames with high accuracy. Regarding the rails on which wheels roll, the use of long welded rails began to omit maintenance and improve the riding comfort. Securing the soundness of such welds is another task. When wheels rotate on rails, the contact pressure at the GPa level works on the contact sections (adhesion/sliding areas) and therefore the welds must be highly reliable.*

*This Nippon Steel Technical Report features railways for the first time in ten years and introduces our latest outcomes of research and development of railway parts. In these ten years, the environment surrounding the railway system has also greatly changed and there are demands for our products to have higher functions and reliability. To resolve such technological issues, we have been promoting research and development for reliability evaluations and higher functionality at higher levels. We will continue research and development to supply railway products to support the railway system also in the future. Please expect to hear about our future outcomes as well.*