News Release

Railway Technical Research Institute　IZUHAKONE RAILWAY　EAST JAPAN RAILWAY COMPANY

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RTRI Successfully Supplies Power to Commercial Trains Using Superconducting Feeding System

– Over one year of operational verification on Sunzu Line and demonstration test results in metropolitan areas on Chuo Line –

Railway Technical Research Institute (RTRI)
IZUHAKONE Railway Co., Ltd.
East Japan Railway Company (JR East)

The Railway Technical Research Institute (RTRI), in cooperation with the IZUHAKONE Railway Co., Ltd. Sunzu Line and the East Japan Railway Company (JR East), has installed a superconducting feeding system on commercial railway lines[Note] and has conducted demonstration tests under actual operating conditions. The results confirmed that power transmission can be achieved while maintaining a stable superconducting state.

[Note]*"RTRI Starts Verification of World's First Power Transmission for Commercial Line Operation Through Superconducting Feeding System," March 13, 2024*
(https://www.rtri.or.jp/eng/press/d2sij10000000kpt-att/d2sij10000000ksa.pdf)
"RTRI Conducts Demonstration Test on Chuo Line, Supplying Power to Commercial Trains Using Superconducting Feeding System," February 25, 2025 (in Japanese)
(https://www.rtri.or.jp/press/g51jdh0000000t2a-att/20250225_001.pdf)

1. Operational Verification on IZUHAKONE Railway's Sunzu Line

(1) Overview

A superconducting feeding system was installed at Ohito Station on the Sunzu Line (Fig. 1) and began operation on March 13, 2024. The system continues to supply power to commercial trains on the line.

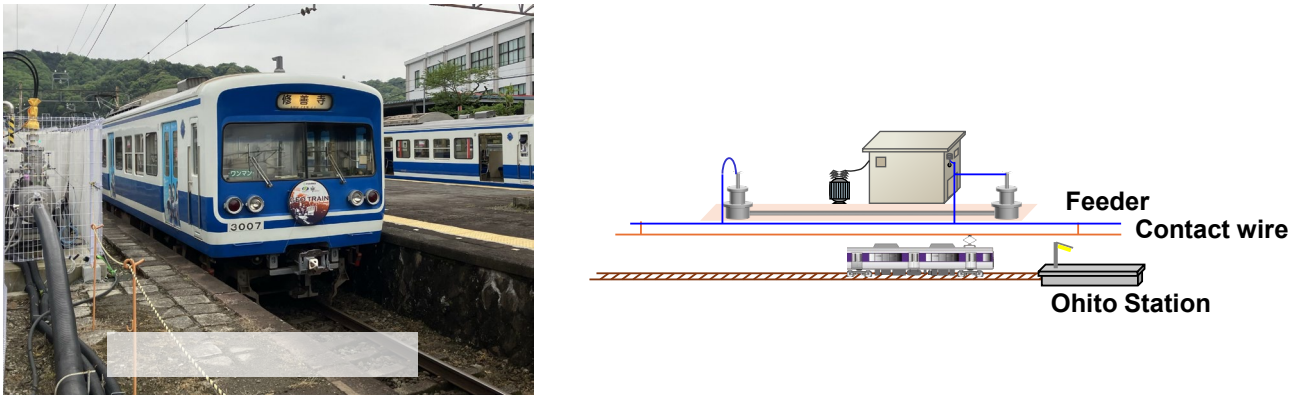

Fig. 1: Train running through power supply section using superconducting feeding system (long-term operation on Sunzu Line)

(2) Status of Operational Verification

Stable operation has been maintained for over one year, supplying power to approximately 40,000 commercial trains to date. The system maintained stable superconducting performance by continuously cooling the internal section of the cable throughout the day (Fig. 2). The current profile remained nearly identical each day (Fig. 3), confirming constant power transmission corresponding to the train load from the first to the last service. The durability of the system over one year of operation was also confirmed.

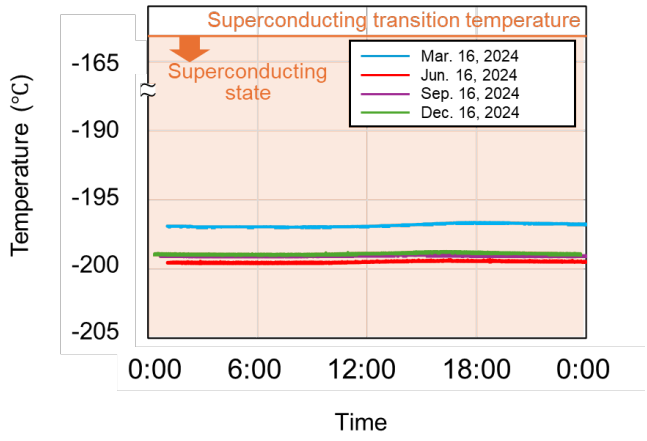

Fig. 2: Daily variation of cable temperature during superconducting feeding system operation

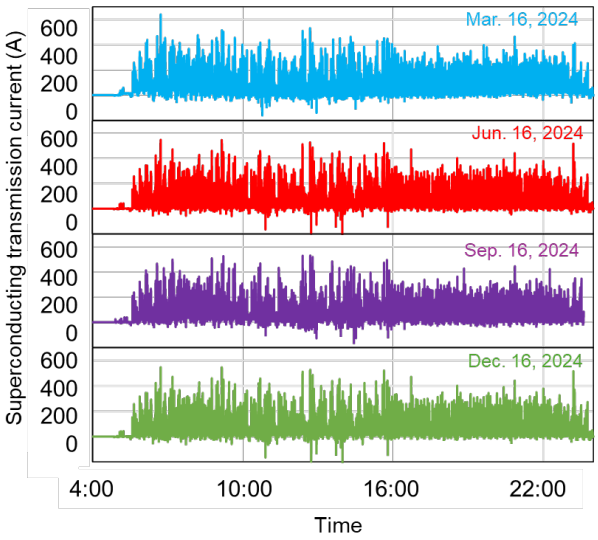

Fig. 3: Daily variation of current transmitted using superconducting feeding system

2. Demonstration Tests on JR East Chuo Line

(1) Overview

A superconducting feeding system was installed at RTRI's Hino Civil Engineering Testing Station adjacent to the Chuo Line (Fig. 4). From March and April 2025, the system was connected to the outbound track of the Chuo Line, supplying power to commercial trains from the first to the last service each day.

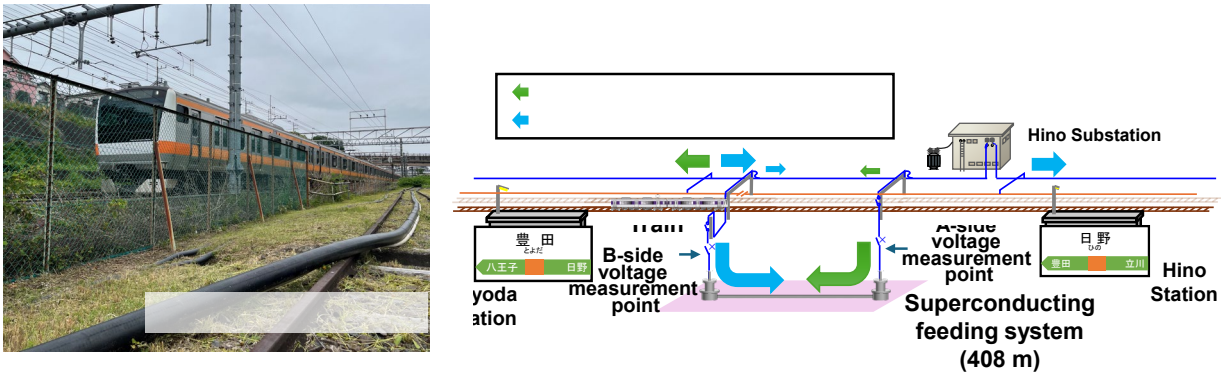

Fig. 4: Train running through power supply section using superconducting feeding system (high-current power supply on JR East Chuo Line)

(2) Demonstration Test Results

In the demonstration tests on the Chuo Line, simulating simultaneous traction operation typical of metropolitan railways, the system successfully supplied a maximum current of 4,500 A (Fig. 5). During regenerative braking, a return current as high as 2,889 A flowed back from the train toward the feeding line (Fig. 6). Even under such high-power supply conditions on a densely operated line where the current magnitude and direction frequently fluctuate, almost no voltage difference occurred between both ends of the superconducting cable. The system operated stably and provided the required power, as confirmed by the data obtained. These results demonstrate that the superconducting feeding system is capable of providing stable power supply in dense metropolitan railway networks.

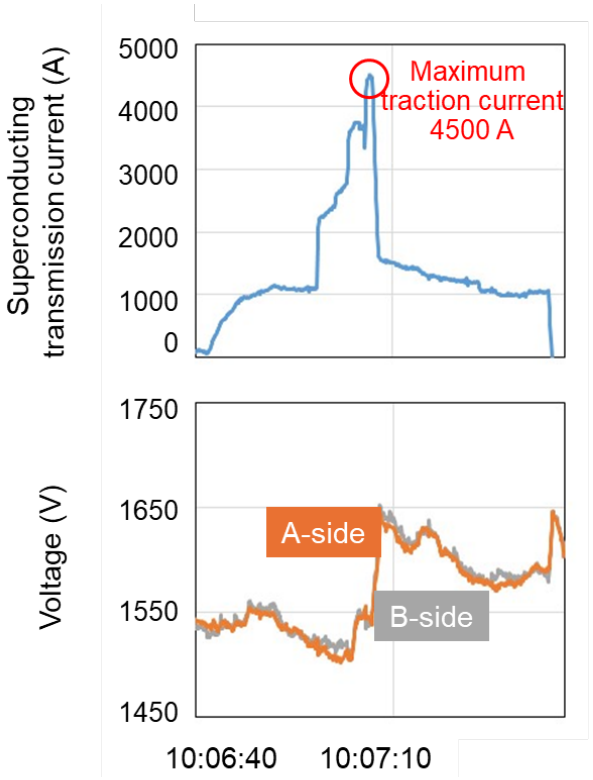

Fig.5: Examples of current and voltage during superconducting traction power supply

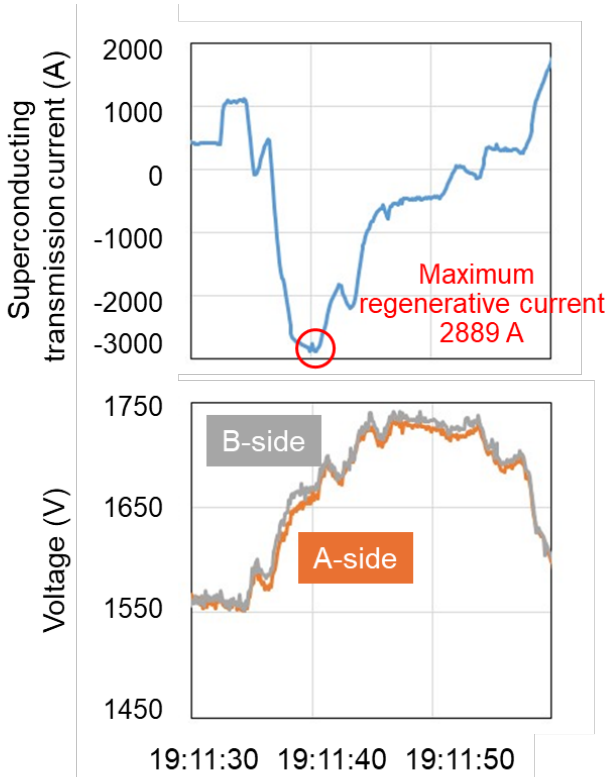

Fig.6: Examples of current and voltage during superconducting regenerative power supply

3. Future Challenges

To realize the benefits of this system—such as consolidation of substations for simplified facility management and reduced maintenance requirements—it will be necessary to achieve longer power transmission distances. RTRI will continue developing technologies for connecting longer cable sections, improving superconducting materials and cooling performance, establishing post-installation management and maintenance methods, and enhancing cost efficiency. These efforts aim to advance research and development toward the social implementation of the superconducting feeding system.

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