News Release

Railway Technical Research Institute

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Proving Test of Superconducting Feeder Cable System Conducted on JR East Chuo Line

The Railway Technical Research Institute (RTRI) has been developing a superconducting feeder cable system. This year, under the support by JR East, the team has connected the system to the power-feeding system of the Chuo Line and conducted power-feeding tests for the first time at home and abroad. In the testing, it was proved that this system is effective in maintaining stable voltage by reducing electrical resistance.

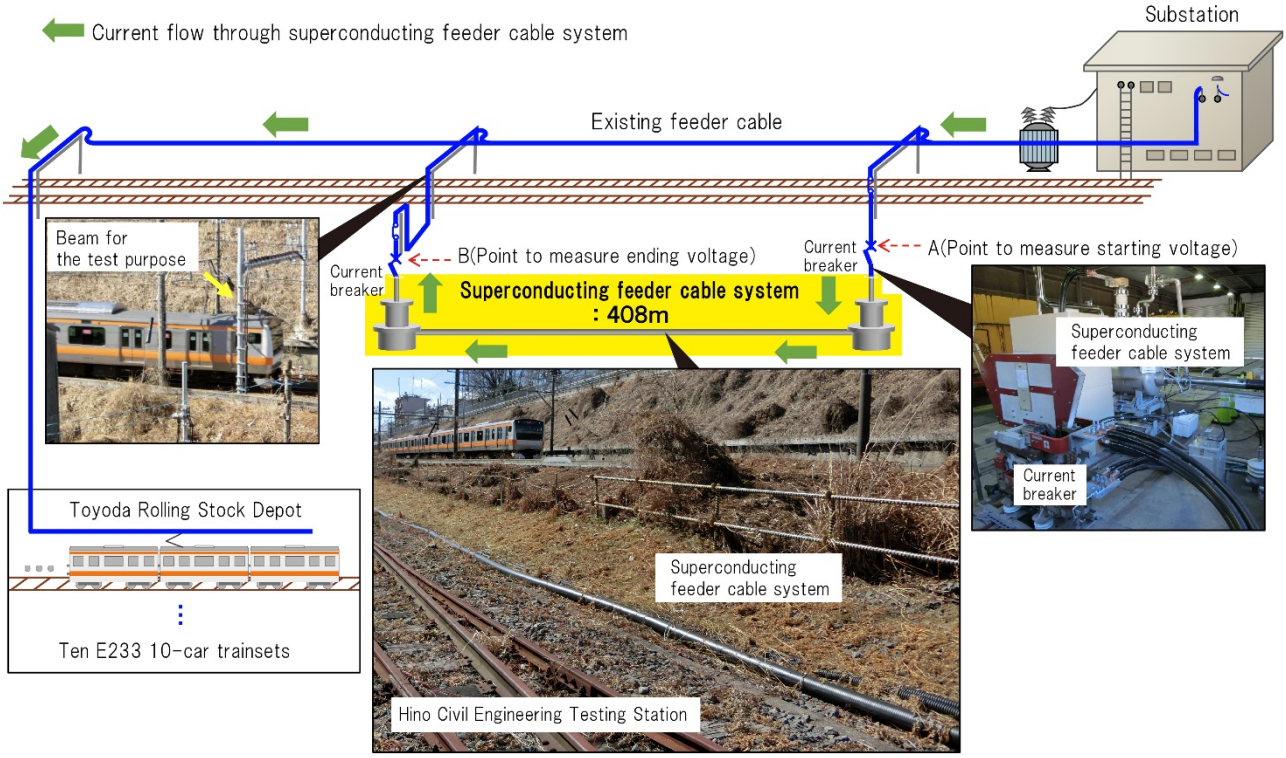

Figure 1: Power feeding system for the tests and current flow

[Test results]

408-meter-long superconducting feeder cable system was installed at RTRI's Hino Civil Engineering Testing Station and its superconducting state was maintained by a cryocooler using liquid nitrogen as a coolant. Then the system was connected to feeder cable running from Hino substation to Toyoda on Chuo Line and test transmission to Toyoda Rolling Stock Depot was conducted after the last train service. (Figure 1) In this test, air conditioning equipment and lighting fixture of ten E233 10-car trainsets were turned on. While the testing, the measured voltage showed almost same level of values at both ends of the system and it was confirmed for the first time at home and abroad that the voltage drop value measured on existing feeder cable, 9.41v, was reduced to below 0.02 v. (Figure 2)

It means that the power loss in this 408-meter range was reduced about 7kW through the transmission by the superconducting feeder cable system.

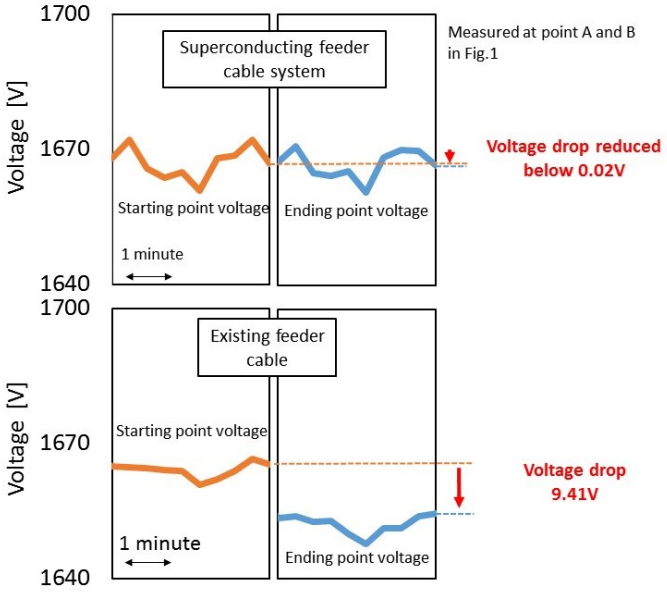

Figure 2: Reduced voltage drop by superconducting feeder cable system

[The effect of the superconducting feeder cable system]

While electricity is transmitted from substations to trains, energy loss is caused by electrical resistance of feeder cable. Therefore, it is required that substations be placed with a close interval in order to prevent voltage drop when trains receive power. When a train applies brake, the kinetic energy of revolving motors is converted to electricity, sent back to feeder cable, and reused to power other trains running nearby. If the train is running in a distant position, however, the regenerated energy cannot be used effectively because resistance of feeder cable increases in proportion to distance.

Since this superconducting feeder cable system can reduce the resistance to almost nothing, it is expected to be an effective solution to the issue of energy loss. Going forward, we will confirm the effects through running tests on commercial tracks, using test trains. At the same time, in order to attain commercially applicable performance level, we will extend the length of the currently 408-meter feeder cable system and improve the cooling performance of the cryocooler in order to keep stable superconductivity in the cable.

✧ Part of this project has been supported by the program to promote creation of Innovation and the program to create future society by the Japan Science and Technology Agency and the subsidy for railway technical development by the Ministry of Land, Infrastructure, Transport and Tourism.