

Tackling the Challenge of Driverless Operation



Trial of Driverless Train Operation System with Yamanote Line.

Trial of BRT Driverless Operation with Ofunato Line.



Objectives

In recent years, remarkable progress has been made in developing driverless operation technology for automobiles. This technology has great potential with regard to addressing various social problems facing Japan as a whole, such as the declining birthrate and aging population and population decline in regional areas.

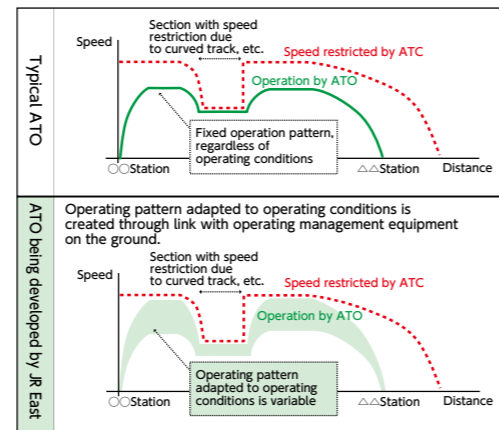
What's more, rolling stock and signalling system control technology have a close affinity with driverless operation technology, and our Group is able to leverage the safe, stable transportation technology that we have developed to date. As part of our growth strategy for a new era, we are tackling the challenge of qualitatively reforming transportation services by enabling driverless operation, while also pursuing safety.

Trial of Driverless Train Operation System with Yamanote Line E235 Series

In addition to general automated operations that support operation by drivers, we are working on implementing driverless operation with personnel on board in case there is a need to deal with an emergency situation or the like.

The automatic train operation (ATO) system that we are developing on the Yamanote Line is a cutting-edge system which, in addition to the typical ATO functions already being implemented by other companies, optimizes operations in response to the operating conditions at a given time (e.g., train delays, unforeseen slowdowns). Trials for the ATO system were conducted from December 2018 to April 2019, using Yamanote Line E235 railcars.

The trials confirmed that the system was generally able to perform at the required level with regard to verification of various operations between arrival at and departure from stations, stopping accuracy, and travel time between stations.



Looking to the Future

We are aiming to pursue qualitative reform of our transportation services by conducting multiple trials, with ensuring safety a prerequisite. Furthermore, by pursuing the mechanization and systematization of tasks for which it is possible to replace human labor by applying cutting-edge technologies, we intend to shift our limited human resources toward creative work that can only be done by people and offer our customers a safe, comfortable transportation environment that will give them greater satisfaction.

Ofunato BRT Driverless Operation Trial

We are operating a BRT (bus rapid transit) system as a sustainable transportation mode on the Kesenuma Line and Ofunato Line, which is contributing to the restoration of communities following the Great East Japan Earthquake.

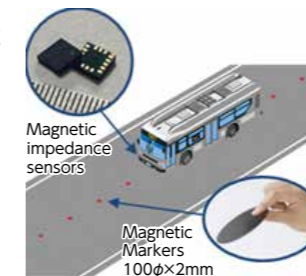
From December 2018 to March 2019, we conducted trials for driverless bus operation technology in the vicinity of BRT Takekoma Station on the Ofunato Line in collaboration with companies participating in the Mobility Innovation Consortium promoting open innovation in public transportation.

During the test, the bus achieved the target automated speed of 40 km/h, and it also reached the target values in terms of lane-keeping control and broadly met the objectives in stopping tests (precise docking control) at Takekoma Station. Furthermore, the system was able to function smoothly with regard to alternating passage of vehicles based on wireless signalling. The trial results were therefore generally favorable.

Key Technical Points Relating to Trial

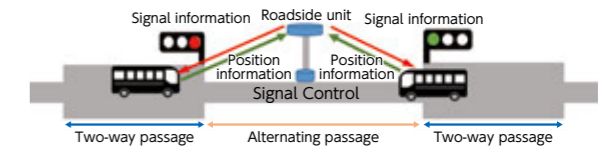
Operation Control by Means of Magnetic Markers

We tested whether buses could be operated smoothly on a dedicated BRT route by installing magnetic markers on the route surface and determining a driverless bus's position by reading information from these markers by means of highly sensitive magnetic sensors (magnetic impedance sensors) installed on the vehicle.



Testing Alternating Passage Based on Wireless Signal Control

We tested alternating passage of driverless buses and oncoming vehicles by means of exchanging vehicle position information using wireless ground-level control equipment. For this trial, we achieved improved reliability by establishing a dual-layer system using LTE (long-term evolution) and 700 MHz-band ITS (intelligent transport system) wireless technology.



Looking to the Future

The ultimate goal of driverless operation technology trials is practical application. To achieve this, many significant challenges need to be overcome besides automating train control and operation, such as service issues, related laws and regulations, and acceptance by society. With practical application in mind, we will continue working to resolve any issues and enable safe, reliable, and sustainable public transportation.

VOICE

Achieving the World's Safest and Most Comfortable Driverless Operation



Transport and Rolling Stock Dept., Railway Operations Headquarters East Japan Railway Company

When we conducted driverless operation trials on the Yamanote Line, there was considerable reaction both inside and outside the company. At present, in order to resolve various issues, we have formed a team comprising drivers, inspection/maintenance personnel, and traffic controllers involved in Yamanote Line operations. Through regular discussions, we are gaining more expertise in train operation and control and how to refine the capabilities of on-board ATO systems. Through incorporating the team members' knowledge, we are working to realize the safest and most comfortable driverless operation in the world.

Moving Forward with Developing a Public Transportation System Suitable for Future Generations



Technology Innovation Headquarters East Japan Railway Company

As the birthrate falls and society ages, Japan's population is expected to decline abruptly, especially in regional areas. As a result of this population decline, transportation systems face major issues, such as labor shortages and revised revenue models. We are leveraging state-of-the-art technology to address these issues and moving forward with developing sustainable public transportation systems suited to future generations.

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