7th RTRI-SNCF Collaborative Research Seminar Held at RTRI

Railway Technical Research Institute, RTRI, held the 7th RTRI-SNCF collaborative research seminar from October 11 to 13, 2016.

RTRI concluded an agreement on collaborative research with the French National Railways (SNCF) in 1995 and has implemented joint research projects in various technical fields. The purposes of this research seminar are to have discussions on R&D management and to give reports of the results of joint research projects. From SNCF, eight people including Ms. Carole Desnost, Vice President Research and Innovation, and from RTRI, 45 people including Dr. Takai, Executive Vice President, participated in this seminar. Mr. Sébastien Codina, Chief of the Engineering, Energy and Environment Division of French Embassy in Japan joined this seminar as well.

On the last day of the seminar, thanks to the cooperation by the Metropolitan Intercity Railway Company, the SNCF delegation had a technical tour to the main depot and substation of the Tsukuba Express Line.

At this seminar, RTRI and SNCF agreed to further promote research collaboration through close communication and to have the next seminar in 2018 in France, and signed the minutes

Ms. Carole Desnost and Dr. Takai signing the minutes

[Meeting on R&D Management]

Management persons of RTRI and SNCF shared views on R&D management, focusing on "application of ICT, big data analysis in particular, to railway operation."

RTRI made a presentation on its research into technologies to quantify, by using ICT, what people have ruled so far, based just on their experience and what we cannot see with eyes. By quantifying various human behaviors, RTRI aims to enhance safety and efficiency in railway maintenance and energy consumption.

Meeting on R&D management

SNCF introduced their projects to raise railways' competitiveness by improving productivity by utilizing ICT, to reduce overall maintenance cost by using preventive maintenance technologies, and to apply technical outcomes achieved by other industries to railways. At this meeting, they agreed to start sharing information on high-precision train position detection technology.

[Speeches by representative persons]

On the 2nd day, RTRI's Executive Director Dr. Okumura made a presentation and Ms. Desnost introduced the research strategy of SNCF.

Presentation by Dr. Okumura

He gave an overview of RTRI's research activities and introduced RTRI's major research projects in the fields of safety improvement, utilization of ICT, energy saving, and efficient maintenance.

In particular, he emphasized the significance of the research into resilience against natural disasters and prevention of human errors. He also stated that it is important to propose solutions for energy issues, to raise competitiveness of railways by cutting cost and to achieve technical breakthrough using digital technologies.

Dr. Okumura

Presentation by Ms. Desnost

She introduced SNCF's technical innovation program "TECH4RAIL" and explained the outline of the technical development attained under this program. Specifically, SNCF are aiming to achieve innovation in railway systems which will "destroy" existing systems by utilizing robot technologies, 3D printing and AI. She also added that It is necessary

Ms. Desnost

to cut the cost of railway operation by introducing self-driving train and efficient maintenance systems, and to enhance competitiveness against other transport modes. She said, in order to achieve this goal, it is essential to introduce new technologies.

[Collaborative research seminar]
At the collaborative research seminar, the researchers made presentations on the outcomes of five projects of the 7th-phase research collaboration implemented between October 2014 and September 2016. The outcomes of each project are as follows:

▪ **Superconducting feeding cable**
   On DC-1500V lines in France, extreme voltage drop can affect trains' smooth acceleration. But it has been found that superconducting feeding cable is able to be a solution to this issue. The effects and versatility of using superconducting feeding cable under the conditions different from Japan was also confirmed.

▪ **Energy storage systems to supply power for railways**
   Case studies of railway energy storage systems were conducted. The data of Japanese energy storage systems and SNCF's research tools were used to compare different power storage systems, such as super capacitors and batteries, and to evaluate the impacts of on-board energy storage systems. Through the research, the performance of the system for railway power feeding under conditions very similar to actual train operation. The results obtained in this project will be utilized in designing energy storage systems.

▪ **Dynamics of new-type railway bridges**
   Specifications of representative types of bridges in Japan and France were compared. As the result, it was found that the difference between the specifications of high-speed railway bridges did not greatly differ between Japan and France.   In addition, it was confirmed that a simulation model is capable of accurately reproducing dynamic response of actual structures when Young's modulus is set at 1.2 time of the design values and modal damping ratios are set at the design values. These findings will be utilized in the dynamic response analysis of railway bridges.

▪ Inspection and preventive maintenance strategies for overhead catenary systems

Information was shared regarding inspection methods and predictive maintenance technology for contact wire and fatigue of contact wire. Research into the wear mechanism of contact wire was implemented as well. A diagnosis method to detect troubles and failures of catenary systems was developed and its effectiveness was confirmed. The research will be continued in order to apply this method to monitoring methods and preventive maintenance strategies.

▪ Simulation models of ballasted tracks

RTRI built a simulation model similar to the analysis model for ballasted track tamping made by SNCF, and conducted analysis. RTRI and SNCF obtained similar results from these analyses and the effectiveness of RTRI model was confirmed. The research and development will be continued toward building a real-scale simulation model of ballasted tracks.

RTRI and SNCF agreed to implement following two joint research projects and six information-sharing projects in the 8th-phase period of the research collaboration, from October 2016 to September 2018.

Joint research projects

Inspection and preventive maintenance strategies for overhead catenary systems
Evaluation of ballasted track maintenance methods using discrete element models

Information-sharing projects

Analysis of train-track interaction to enhance running safety
Development of high-precision train position detection technology
Others

In addition, RTRI proposed to start a new project on the topic "a method to predict deformation based on changes in monitoring data of railway infrastructure."

Outcomes of 7th-phase projects reported