Contribution to the achievement of SDGs by Furukawa Electric Group

Initiatives for Creating New Businesses in the Infrastructure DX Domain of Furukawa Electric

– Strategic Business Development of “Michiten” and “Tetsuten” –

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ABSTRACT In recent years, the shortage of human resources and the financial burden on the maintenance and management of social infrastructures have become serious problems. To address these challenges, Furukawa Electric developed “Michiten” and “Tetsuten,” innovative maintenance solutions that utilize vehicles equipped with dashboard cameras.

The “Michiten” series has improved the efficiency of inspections of roadside equipment across the country and is increasingly being adopted by local governments and police forces. The “Tetsuten” has also been adopted in the railway industry, and by integrating it into Keio Corporation’s Geographic Information System (GIS) platform, progress is being made in the registration of electrical equipment.

Going forward, Furukawa Electric will continue to promote Digital Transformation (DX) in the maintenance and management of social infrastructures, aiming to expand the use of “Michiten” among local governments and to introduce new functions to “Tetsuten” for railway companies.

1. INTRODUCTION

The Social Design and New Business Development Department is the organization with the goal of creating new businesses that contribute to solving social issues in order to achieve the Furukawa Electric Group Vision 2030. Utilizing design thinking and lean startup methods, the company is tackling new business ventures while quickly changing direction based on the voice of customers, and has primarily been creating new businesses in the fields of social infrastructure maintenance and management (infrastructure DX, Infrastructure Laser), life sciences, and space.

In particular, in the Infrastructure DX area, we have developed the “Michiten” series of maintenance/inspection support solution for roadside equipment and the “Tetsuten” of maintenance/inspection support solution for railroad line facilities for the maintenance and management of infrastructure facilities, which are facing serious manpower shortages and increasing costs, and we have introduced the challenge of social implementation in the previous reports[1].

To date, the “Michiten” has been introduced in more than 100 cases nationwide, and is under review by several prefectural police departments. The “Tetsuten” has been introduced to Keio Corporation, and Proof-of-Concept (PoC) for the introduction of the system is underway with several rail operators.

This paper introduces Furukawa Electric's approach to the actual issues faced at inspection sites and how to use the analyzed data gathered from recent case studies.

2. INFRASTRUCTURE DX INITIATIVES – Development Background and Product Overview of “Michiten” and “Tetsuten”

In recent years, there have been a series of accidents in which roadside equipment across the country have collapsed due to aging and other factors. As shown in Table 1, the number of reported cases is on the rise.

Many road managers do not have sufficient budgets to maintain all roadside equipment, and some road authorities have taken no action at all. We conducted repeated interviews at the site to identify the current state of roadside equipment maintenance management, and found

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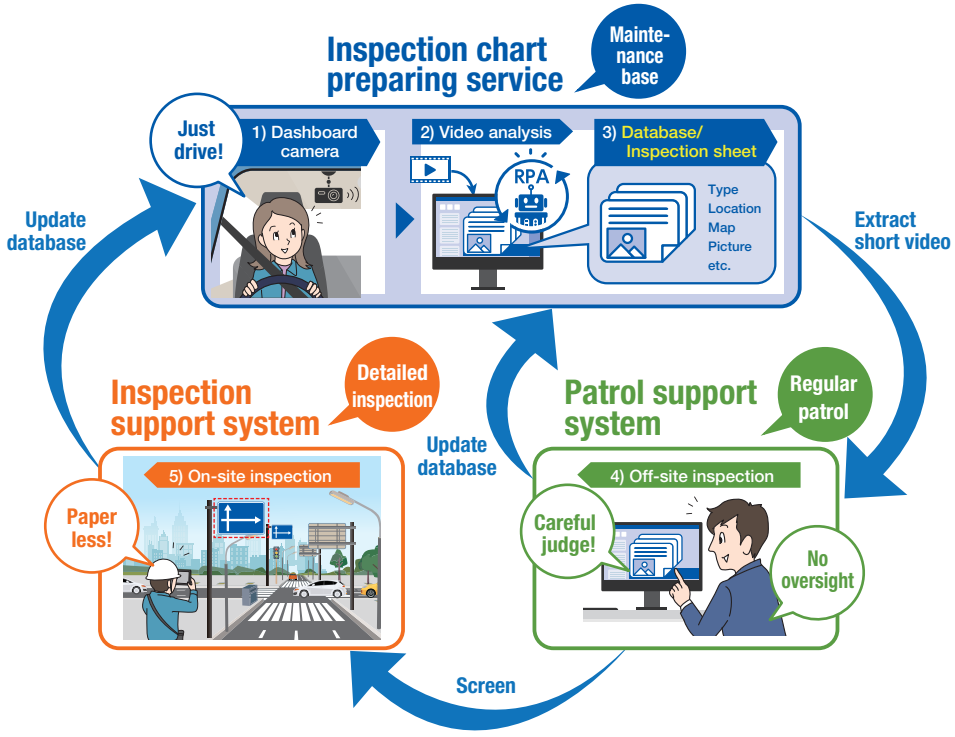
Table 1 Cases of personal injury caused by collapsed roadside equipment.

Occurrence Time	Place	Accident Summary	Details of the damage etc.
Sep. 2024	Hino city, Tokyo	Falling branches of street trees	A branch broke off and fell on a ginkgo tree-lined street in Hino City, Tokyo, crushing a pedestrian (36 years old) to death.
Jul. 2024	Shizuoka city, Shizuoka	Collapse of a traffic light pole	A traffic light pole on a city road fell and hit a car traveling in the opposite lane, but the woman driving the car was not injured.
May 2024	Matsumoto city, Nagano	Collapse of a convex mirror	An incident occurred in which a convex mirror installed on a city road collapsed due to corrosion at the base of the steel pole.
May 2024	Hita city, Oita	Collapse of a road sign	A road sign on a city road broke off at the base of the pole, causing a minor injury to a female student (first grade) on her way home from school.
May 2024	Niihama city, Ehime	Collapse of a convex mirror	A convex mirror on a city road fell over, causing minor injuries to an elementary school student walking nearby.
Apr. 2024	Kobe city, Hyogo	Collapse of a traffic light pole	A pedestrian traffic light collapsed at an intersection. It is believed to have been caused by deterioration of the traffic light. No one was injured.
Feb. 2024	Shibuya-ku, Tokyo	Collapse of a street light	A street light on a sidewalk collapsed on Dogenzaka. No one was injured.
Nov. 2023	Edogawa-ku, Tokyo	Falling of an intersection sign plate	An intersection sign installed on a ward road fell and struck a woman (in her 70s) who was crossing the street, causing a laceration to her head.
Aug. 2023	Tottori city, Tottori	Collapse of a street tree	A 21-meter-high tree planted along a prefectural road in Tottori City suddenly collapsed, slightly injuring a woman who was passing by.
Jun. 2023	Oirase town, Aomori	Collapse of a road sign	A road sign on a footbridge on a town road collapsed, hitting an elementary school student's backpack on his way home from school. The student was not injured.
Mar. 2023	Hiroshima city, Hiroshima	Collapse of a street tree	A roadside tree fell onto the road on Peace Boulevard in Naka-ku, Hiroshima, colliding with a parked car.
Dec. 2022	Marugame city, Kagawa	Collapse of a convex mirror	A convex mirror on the side of a city road fell over and hit the front basket of a woman’s bicycle, causing minor injuries such as a head injury. This is believed to have been caused by corrosion or strong winds.
Aug. 2022	Nagoya city, Aichi	Collapse of a street tree	A zelkova tree on the sidewalk fell over and hit two cars, one of which was dented. No one was injured.

* Created based on news articles, etc.

that there were limitations to the current human wave management method for managing the number of objects, their locations, and panoramic views.

To deal with the job of performing a huge amount of maintenance management while linking the necessary information, Furukawa Electric developed the “Michiten” series as a new DX solution for roadside equipment (Figure 1).



“Michiten Snap” is to create a digital database.
“Michiten Cruise” is to extract data and performs patrol inspections.
“Michiten Assist” is to visit the site for detailed inspections.

Figure 1 Product relationship diagram of “Michiten”.

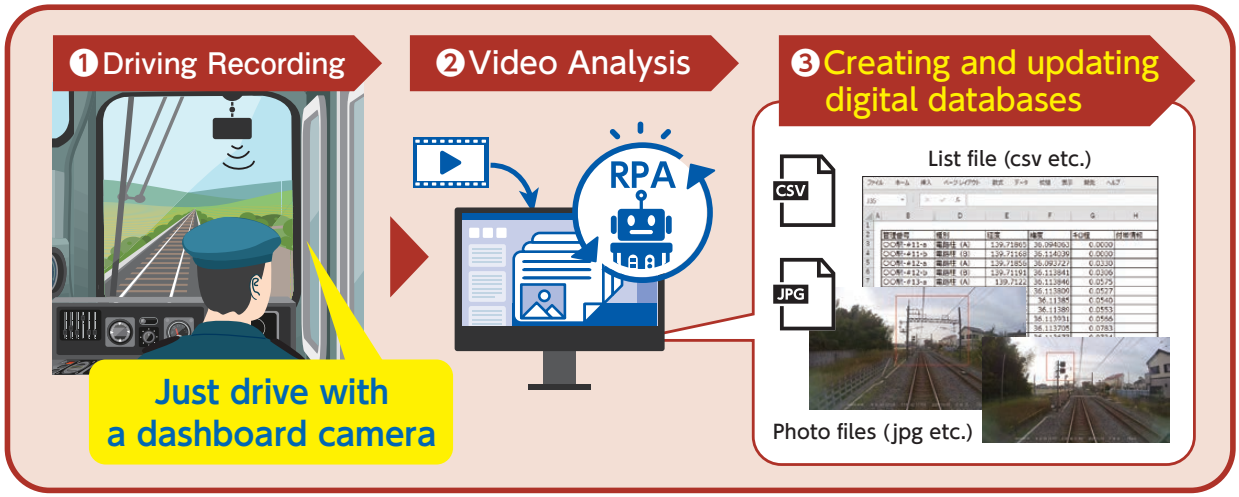


Figure 2 Data analysis process of the “Tetsuten”.

Furthermore, we changed the segment from roads to railways and released the “Tetsuten” which has the same functions of the “Michiten” as the Maintenance/Inspection Support Solution for Lineside Facilities (Figure 2). The major difference between the “Michiten” and the “Tetsuten” is that road inspections are carried out based on the inspection format and inspection procedures issued by the Ministry of Land, Infrastructure, Transport and Tourism, while railway inspections vary by operator, so they are customized.

3. MAJOR IMPLEMENTION RESULTS OF THE “MICHITEN” SERIES

3.1 Roadside Equipment Inspection Support Demonstration Experiment With Osaka Prefecture

In this demonstration experiment, a vehicle equipped with a dashboard camera was driven along the approximately 12.3 km section of National Route 176, which was transferred from the national government to Osaka Prefecture in 2020, from the Hyogo Prefecture border to the Osaka City border (Obe 2-chome, Kawanishi City, Hyogo Prefecture to Niitaka 3-chome, Yodogawa-ku, Osaka City, Osaka Prefecture), to capture video and perform video analysis using the “Michiten” series. As a result, the location information of scattered road guide signs and road lighting facilities (approximately 650 units) was extracted, and a digital inspection sheet (facility specifications) and list were automatically generated (Figure 3).

By accurately capturing the current situation of approximately 650 signs and facilities, we were able to identify those that “did not have a past inspection schedule” or that “had been removed”, confirming the effectiveness of the “Michiten” series in capturing signs and facilities.

3.2 Oita City “Roadside Equipment (Road Reflectors) Survey Work”

Using Furukawa Electric’s roadside equipment maintenance management solution “Michiten” series, a digital database of road reflectors in Oita City was created. By analyzing the video captured by driving a vehicle

Figure 3 Example of an inspection sheet.

equipped with a dashboard camera, the exact location information and installation status of scattered road reflectors (approximately 400 units) were extracted, and by comparing it with the management chart data owned by the Civil Engineering & Construction Department, Road Maintenance Division of Oita city, the exact installation locations were identified. In addition to enlarged views of the mirror surface, images from multiple angles such as the back and base were cut out and pasted into the database, and information on equipment such as the mirror dimensions and the shape of the support poles was also acquired in the database. In addition, while the “Michiten” series previously supported road signs and road markings, this project was the first to acquire data on road reflectors.

3.3 Saitama Prefectural Police Headquarters’ “Traffic Control Road Signs and Road Markings Installation Status Survey”

In the work at Saitama Prefectural Police Headquarters, the Furukawa Electric roadside equipment maintenance management solution “Michiten” series was used to survey the exact location information, the sign board type, the installation status, etc. of traffic control road signs and road markings, and to create a digital database, with

the aim of helping to implement appropriate traffic regulations and to maintain road signs, etc.

Initially, road markings such as pedestrian crossings and double stop lines, which were not the target of the “Michiten” series, were also included in the data acquisition target, and information on approximately 1,000 road signs and road markings were acquired. Even in cases where sign boards were installed in multiple directions on a single sign pole, it was possible to distinguish and acquire sign boards installed not only in the front direction but also in the side and back directions (Figure 4 and 5). Furthermore, it was confirmed that the characters written on the acquired sign boards, including the accompanying auxiliary boards, were legible. We were also able to obtain data on road markings such as pedestrian crossings that have become less visible due to aging (Figure 6). We also developed a dedicated viewer that allows users to centrally view digital database and facility photos for this business, improving the convenience of data management.

3.4 Individual Construction Plan Formulation Work for Roadside Equipment in Mihara City, Hiroshima Prefecture

In order to prevent traffic impacts and third-party damage caused by falling or collapsing roadside equipment due to damage or corrosion, Mihara City, Hiroshima Prefecture, is promoting a shift from “reactive maintenance” to “preventive maintenance” infrastructure maintenance, and has introduced the “Michiten” series to improve the efficiency of inspection and management work through digitalization, to ensure safety, and to optimize costs.

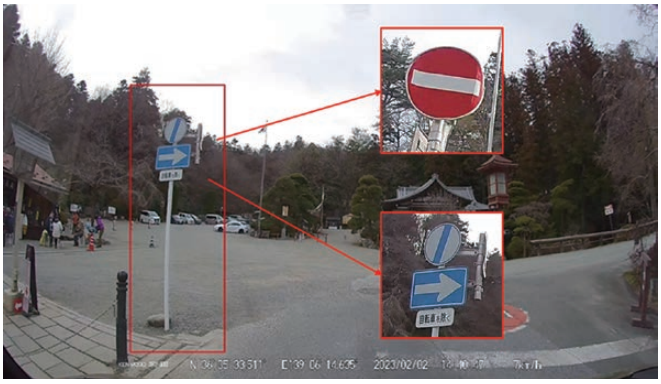


Figure 4 Examples of signboards located in both the front and side direction.

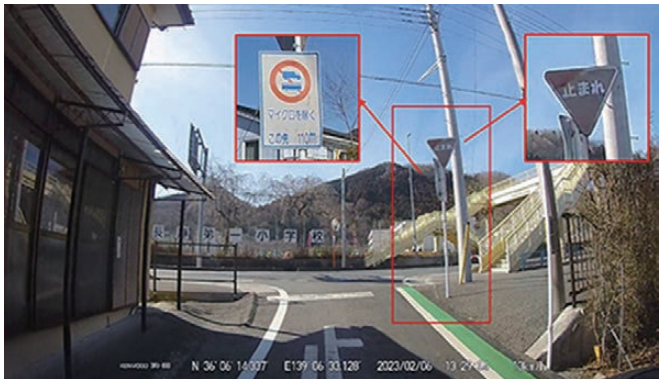


Figure 5 Examples of signboards located in both the front and rear directions.

Figure 6 Examples of road marking with reduced visibility.

In this project, a vehicle equipped with a dashboard camera was driven along 41.5 km of roads in Mihara City to capture video, and a digital database was created by extracting the location information of 390 scattered roadside equipment through video analysis using the accessory inspection sheet creation service “Michiten Snap”. In addition, a patrol inspection was conducted using the accessory inspection support system “Michiten Cruise” for roadside equipment that were determined to need repair based on a simple deterioration assessment, and for roadside equipment that were difficult to assess because their bases were covered by vegetation, Chuden Technical Consultants conducted a detailed inspection on-site using the accessory inspection support system “Michiten Assist” (Figure 7 and 8).

The patrol inspection using “Michiten Cruise” this time reduced the number of days of on-site work required by approximately five days compared to the conventional method of visually inspecting all roadside equipment, and the detailed inspection using “Michiten Assist” reduced the number of days of on-site work required by approximately 14 days.

Figure 7 Examples of damage confirmed during patrol inspections by “Michiten Cruise”.

Figure 8 Example of an inspection sheet by “Michiten Cruise”.

4. KEIO ELECTRIC RAILWAY’S TECHNOLOGY DEPARTMENT ADOPTS FURUKAWA ELECTRIC’S “TETSUTEN”

Keio Corporation was considering creating a digital database for electrical equipment to visualize it on a map, just like railway civil engineering structures, using its proprietary GIS platform “KEIO Platform and Systems” (K-PaS), and to share the on-site facility status between the railway’s technical departments (engineering department and electrical department).

In response to the above, Furukawa Electric has used its “Tetsuten” of the Maintenance/Inspection Support Solution for Lineside Facilities to analyze a total of 16 types of approximately 8,000 pieces of railway electrical equipment, including power poles that support the electric line and special light-emitting signals that notify of abnormalities at railroad crossings, on the entire Keio Line and Inokashira Line, excluding tunnels and depot lines, making a significant contribution to the creation of a digital equipment database (Figure 9 and 10).

[Lines analyzed (stations in brackets)] *Tunnel sections excluded

Keio Line (Shinjuku Station to Keio-hachioji Station), Takao Line (Kitano Station to Takaosanguchi Station), Sagamihara Line (Chofu Station to Hashimoto Station), Keibajo Line (Higashi-fuchu Station to Fuchukeiba-seimommae Station), Dobutsuen Line (Takahatafudo Station to Tama-dobutsukoen Station), Inokashira Line (Shibuya Station to Kichijoji Station)

Keio Corporation plans to import the database obtained from “Tetsuten” into “K-PaS” and start operation during fiscal year 2024.

Figure 9 Power pole.

Figure 10 Special flashing signal light.

5. CONCLUSION

The “Michiten” series and “Tetsuten” developed by Furukawa Electric have made great strides in DX for road and railway maintenance and inspection by simply installing a dashboard camera and driving. In addition, as the cases presented in this paper, by listening to customer feedback and thinking about things from the perspective of the field, it has become possible to provide new customer value. The cases presented in this paper and future prospects are summarized below.

In a “Road Reflector (Convex Mirror) Survey” in Oita City, Oita Prefecture, we used multiple dashboard cameras to take pictures from multiple angles and analyze them in response to customer requests to have “Michiten” inspect the base of the convex mirror, which is prone to deterioration. Many local governments do not know the number or condition of convex mirrors, and we believe that the need for the “Michiten” to digitally record and improve inspection efficiency will increase in the future.

In the “Traffic Control Road Signs and Road Markings Installation Status Survey” at Saitama Prefectural Police Headquarters, in order to help with the implementation of appropriate traffic regulations and the maintenance and management of road signs and road markings, Furukawa Electric made “Michiten” compatible with not only road signs but also road markings for the first time, and conducted a digital database and status survey. Police headquarters in other prefectures have similar issues, and we are currently conducting verification with several police headquarters.

In the “Individual Roadside Equipment Construction Plan Development Project” in Mihara City, Hiroshima Prefecture, the aim was to shift to “preventive maintenance” infrastructure management, and the efficiency of inspection and management work was improved using digital technology. As part of this, a screening service with simple deterioration judgment using the roadside equipment patrol support system the “Michiten” Cruise was adopted for the first time. As a result, a system was established in which only equipment that were determined to need repair by screening were inspected in on-site detail, and work efficiency was improved. This model is thought to contribute to solving the problem of transitioning to a “preventive maintenance” model faced by local governments. In addition, the increase in road tree collapse accidents in recent years has become a serious social issue. In response to this, Furukawa Electric is promoting the use of the “Michiten” series so that it can be actively used in maintenance work such as road tree database maintenance and inspection.

Keio Corporation has adopted the “Tetsuten”, which can obtain highly accurate location information, to visualize electrical equipment on a map and to improve the efficiency of maintenance and management of the equipment. It has created a digital database of electrical equipment so that it can be imported into “K-PaS”. The “Tetsuten” is being adopted by railway companies other than Keio Corporation, and in addition to digital database creation, it is also developing a patrol support service that uses high-resolution images such as 4K and a function to automatically extract status changes.

We will continue to look directly at “sites”, “actual items”, and “realities” and listen carefully to our customers’ voices, and will continue to expand the use of the “Michiten” in local governments and add new functions to the “Tetsuten”, creating technology that makes society safer and aiming to realize a “town of the future” where no one is left behind.

REFERENCE

1) Takashi Kawate, Tetsuya Kon, Akira Tachibana: “Digital Transformation of Infrastructure Maintenance Provided by Furukawa Electric”, Furukawa Electric Review No.54 (2023).