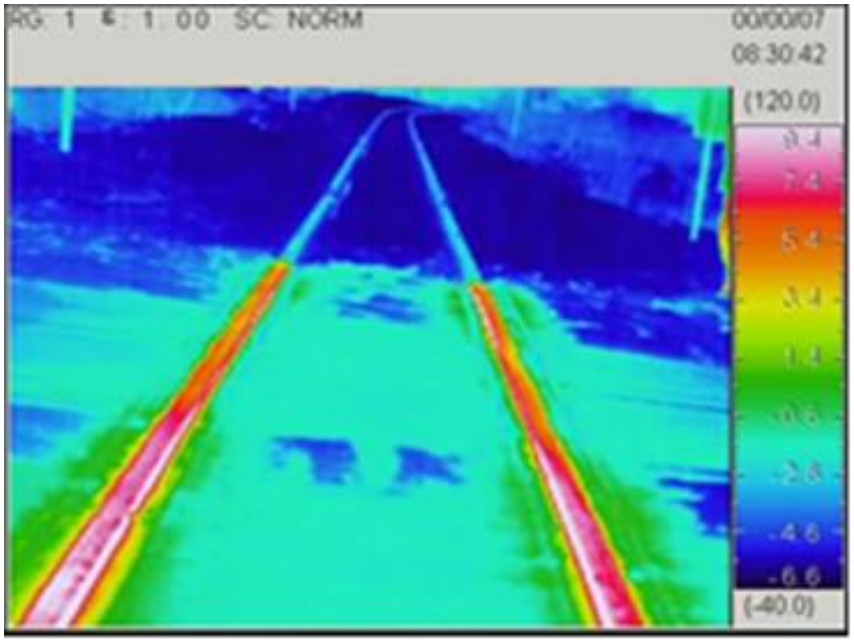
COUNTERMEASURES FOR DERAILMENT AT LEVEL CROSSINGS IN WINTER



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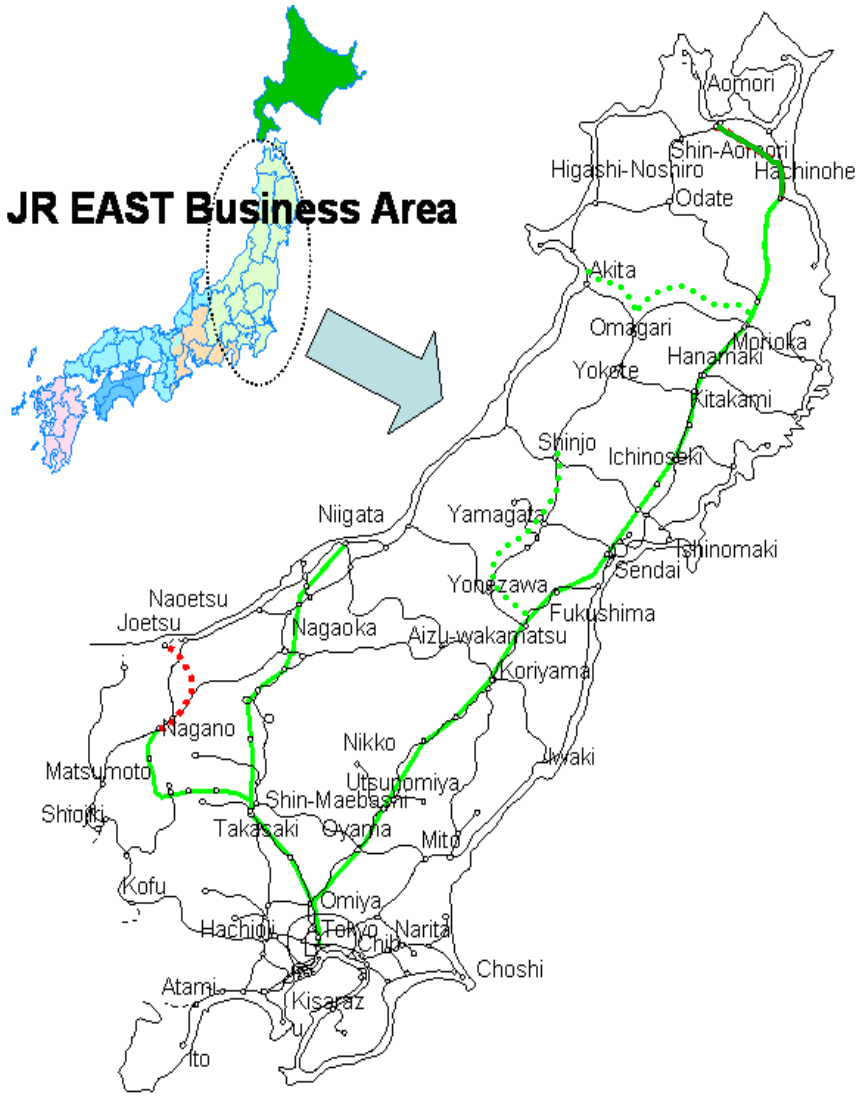
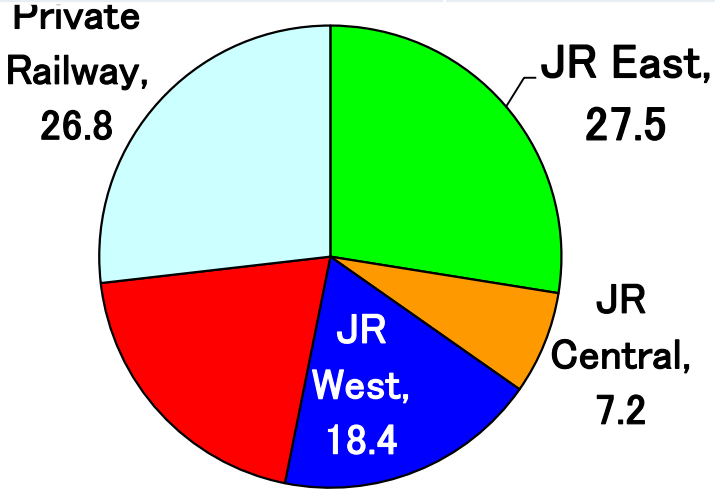
Introduction



- 5-line Shinkansen network

Passenger Line Network	7,512.6 km
Average Number of Trains Per Day	12,784
Average Number of Passengers Per Day	16.80 million



Introduction

Number of Level crossings

7,049

1,800 level crossings require snow removal.

Typical Japanese Level crossing

RTRI type crossing

Precast prestressed crossing

Introduction

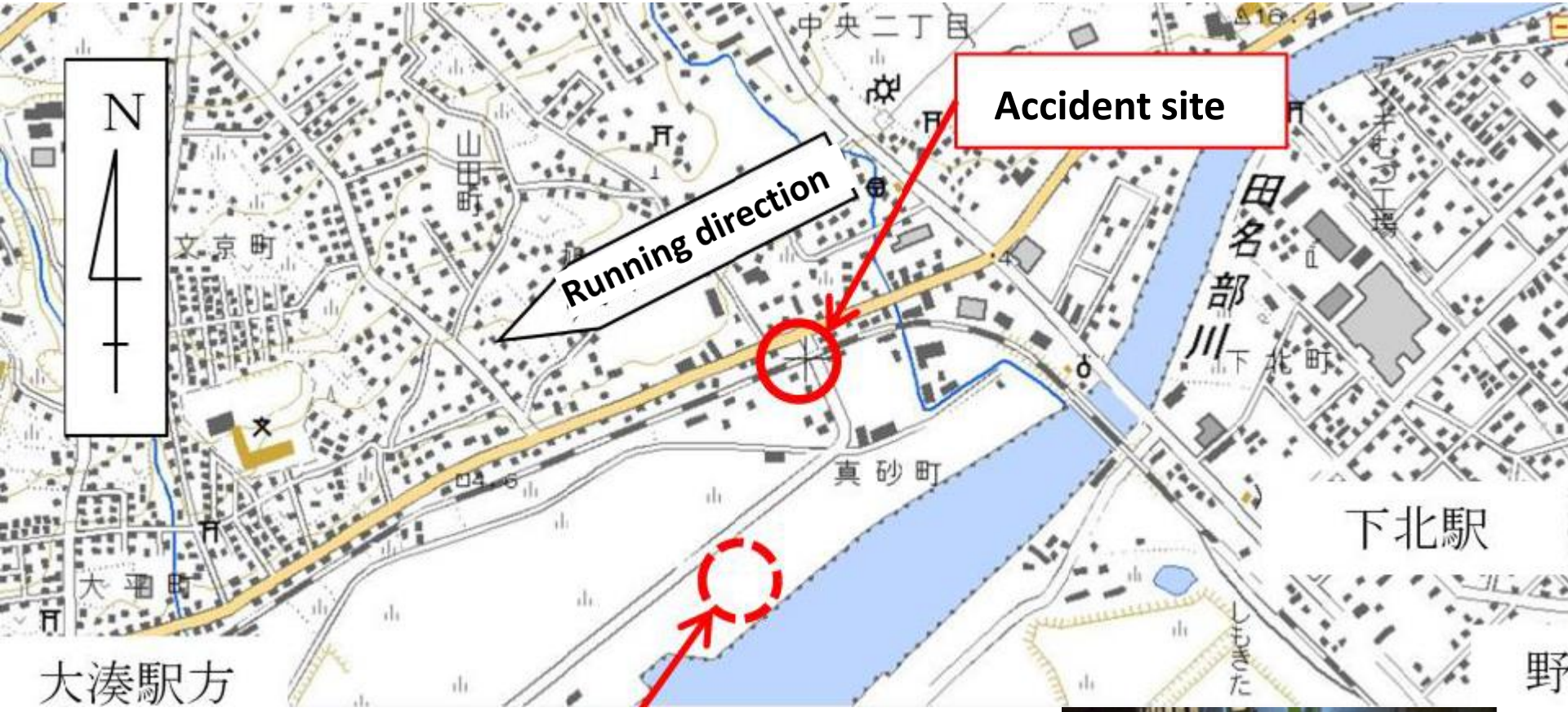
Snow removal work

Snow cleaning car

Manned removal

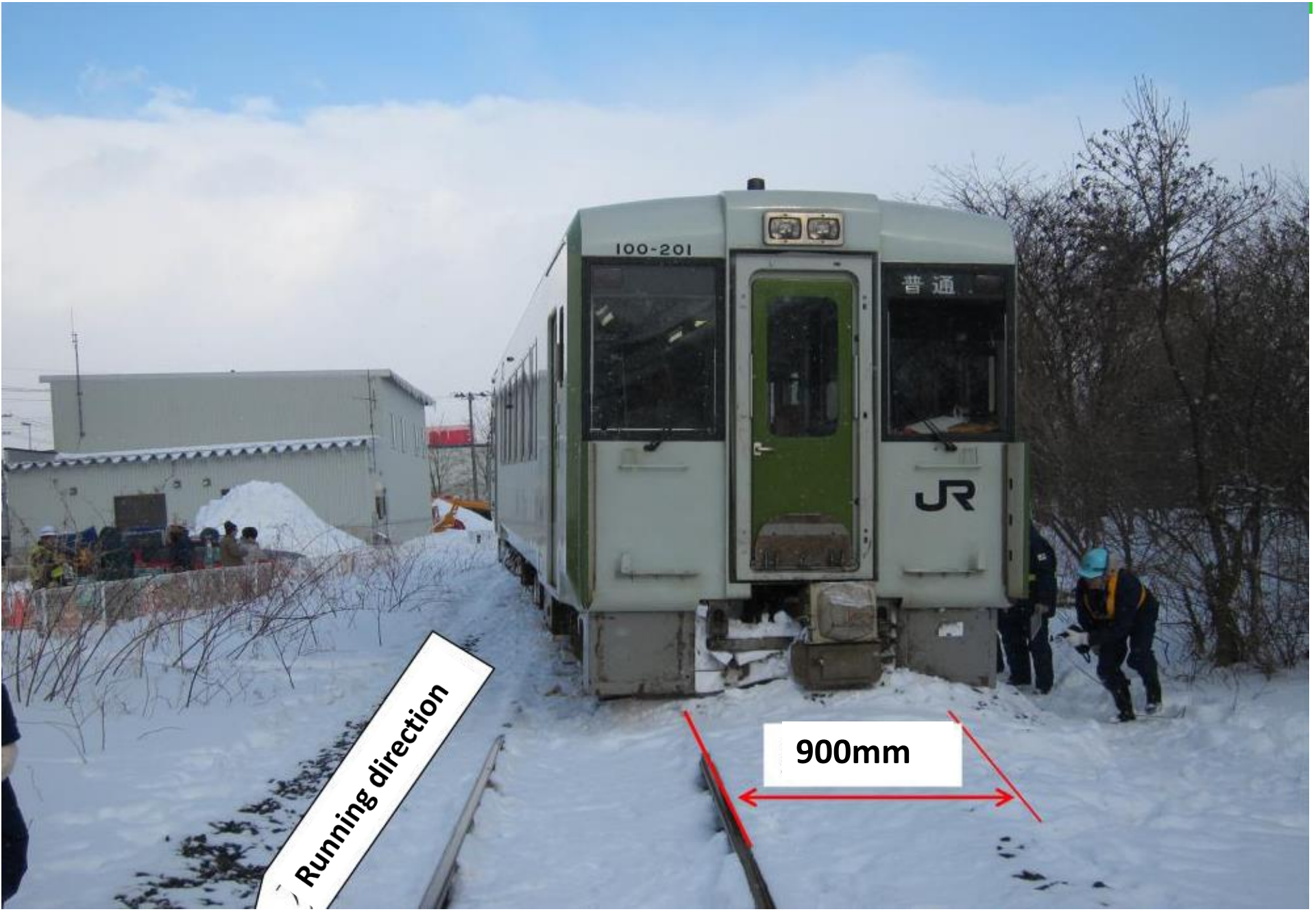
Level crossing with snow removal device

Derailment accident

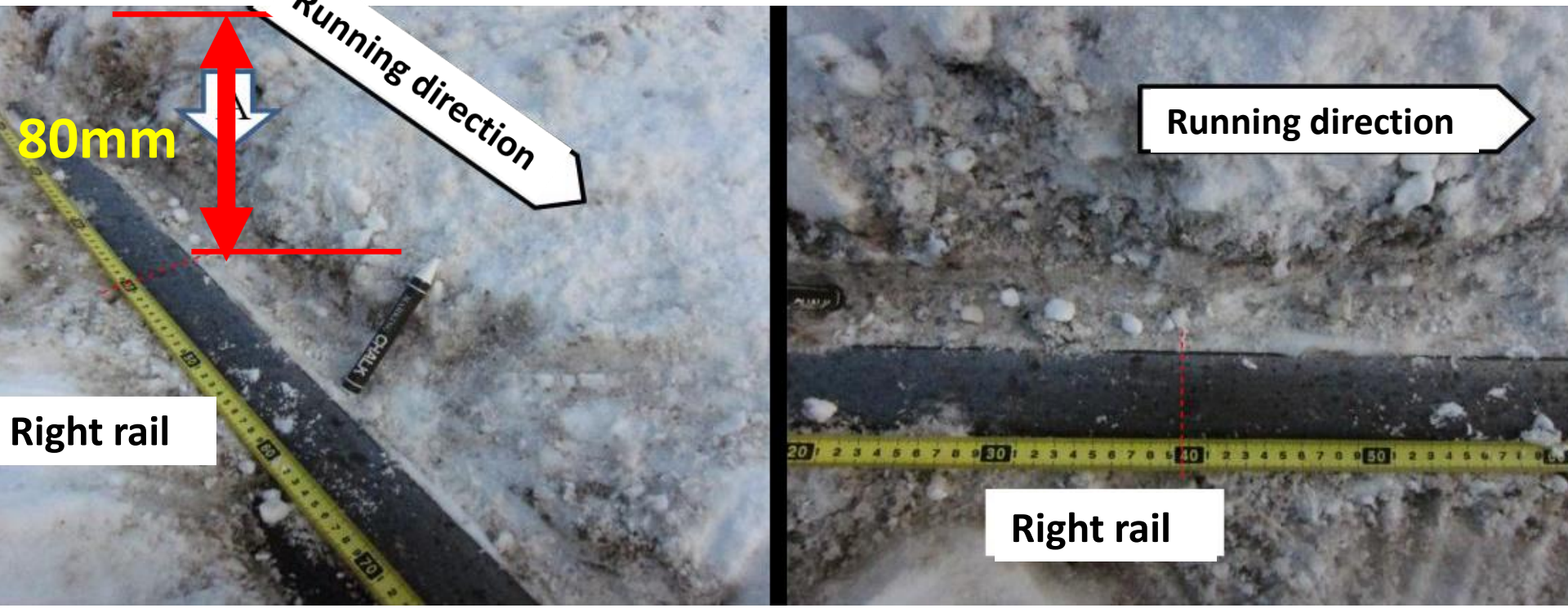


Snow disposal area

Derailment accident



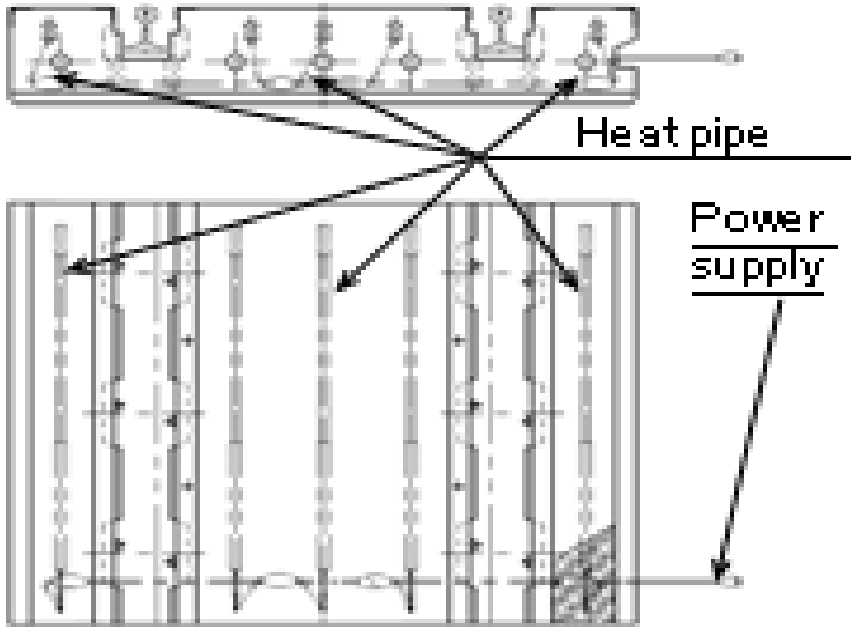
Derailment accident



Cause of the accident

After a long period of time without train passage, the flange way was filled with compressed and hardened snow, so the train rode onto the rail.

Conventional level crossing heater



Calorie is over 300W/m²

Purpose of development

To prevent this kind of derailment

⇒ Installation of heater is effective, but cost is high.

Develop low-cost heaters for the flange ways

Concept

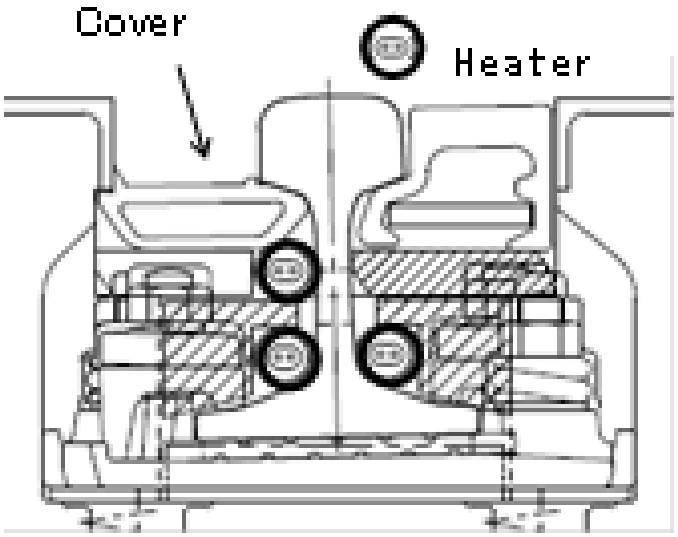
Basic requirements

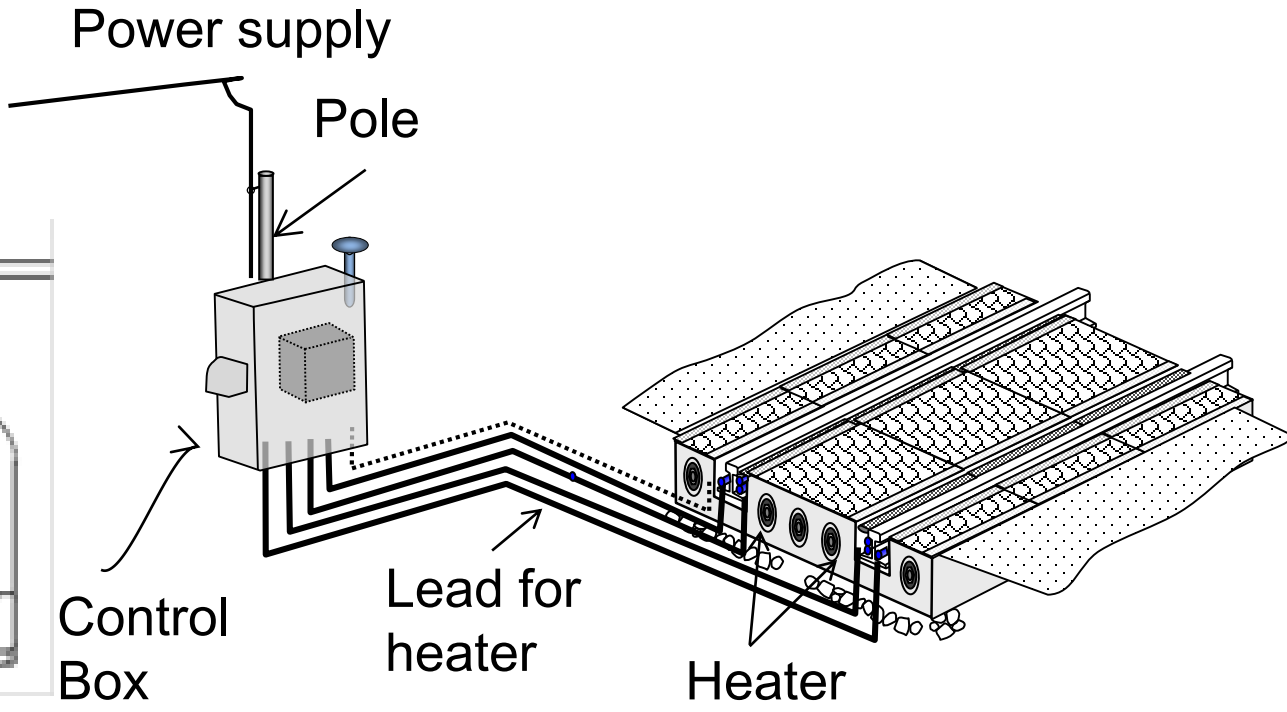
1. No need to change structure of level crossing to install heater.
2. Calorific value of electric heater used is over 300W/m^2
3. Double insulation between heater and rail.

Basic specifications

1.Can be controlled automatically after turning on power
2. Heat capacity 195 w per meter of rail
3. Self-control type heater, saving energy at high temperatures
4. Temperature control based on outside air temperature, snowfall, and rail temperature.

Heater design



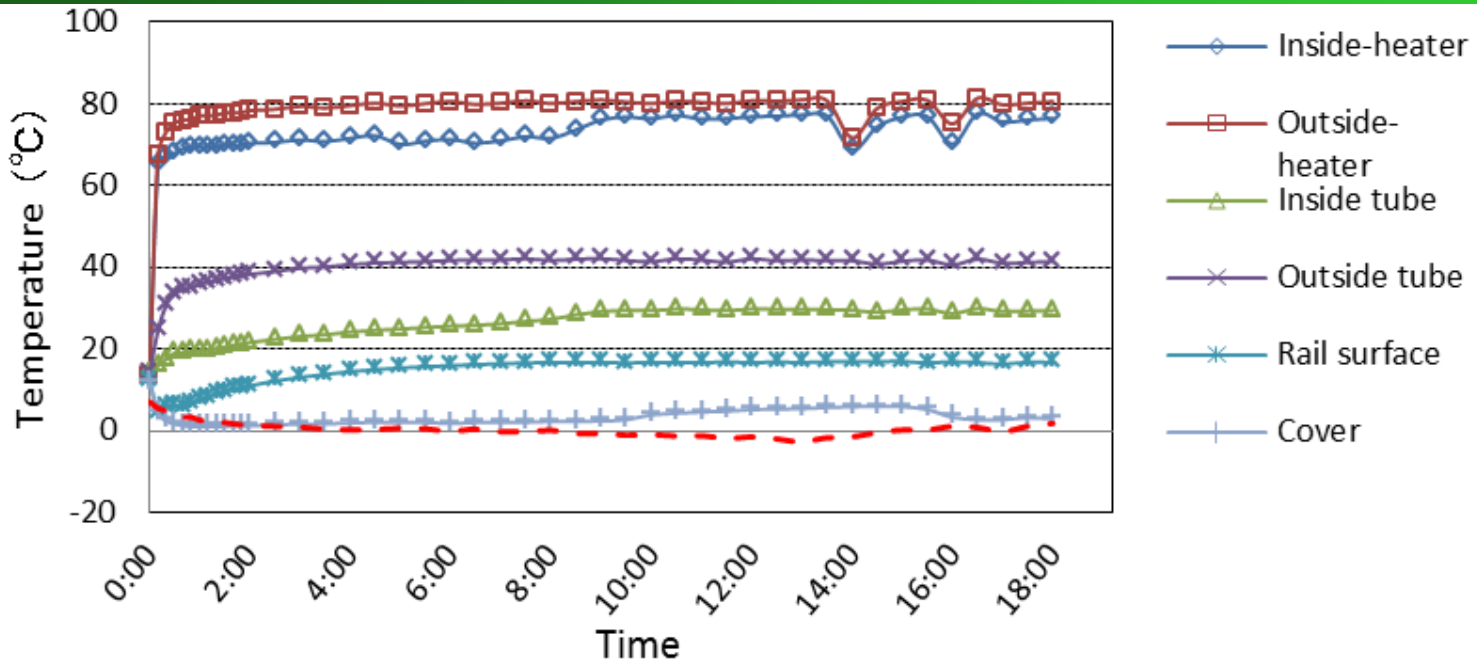


Preliminary test

Test pieces

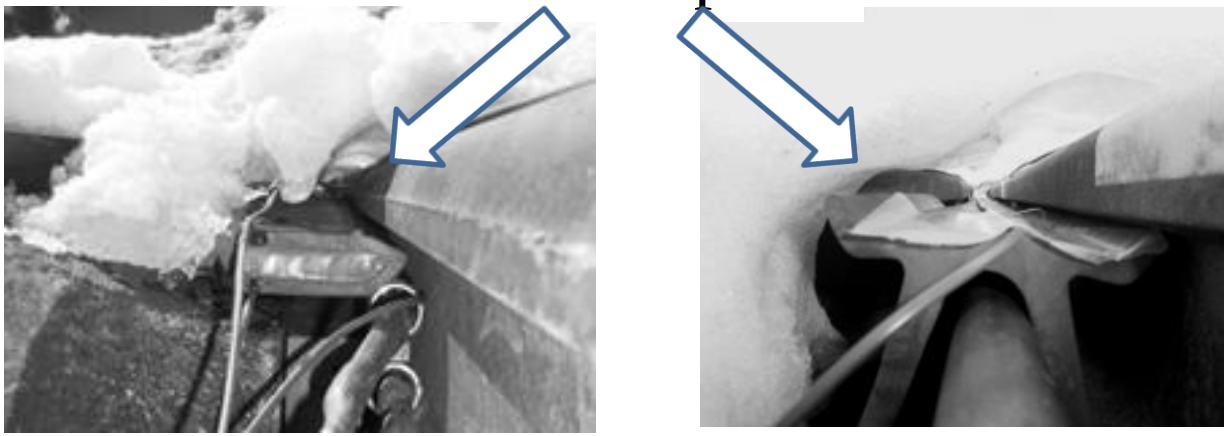
Test condition

Test results



Measured temperature of each part

Vacant space



Snow condition after 17 hours

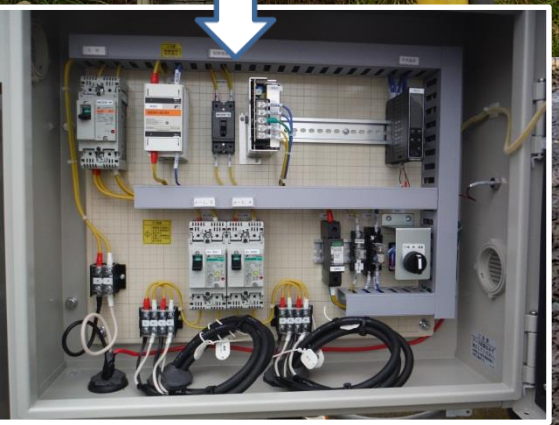
Installation

Target crossings

1. No snow melting device installed
2. High frequency of dump truck traffic
3. Difficulty in snow removal

The number of level crossings satisfying the above conditions was 53.

Installation of new heater

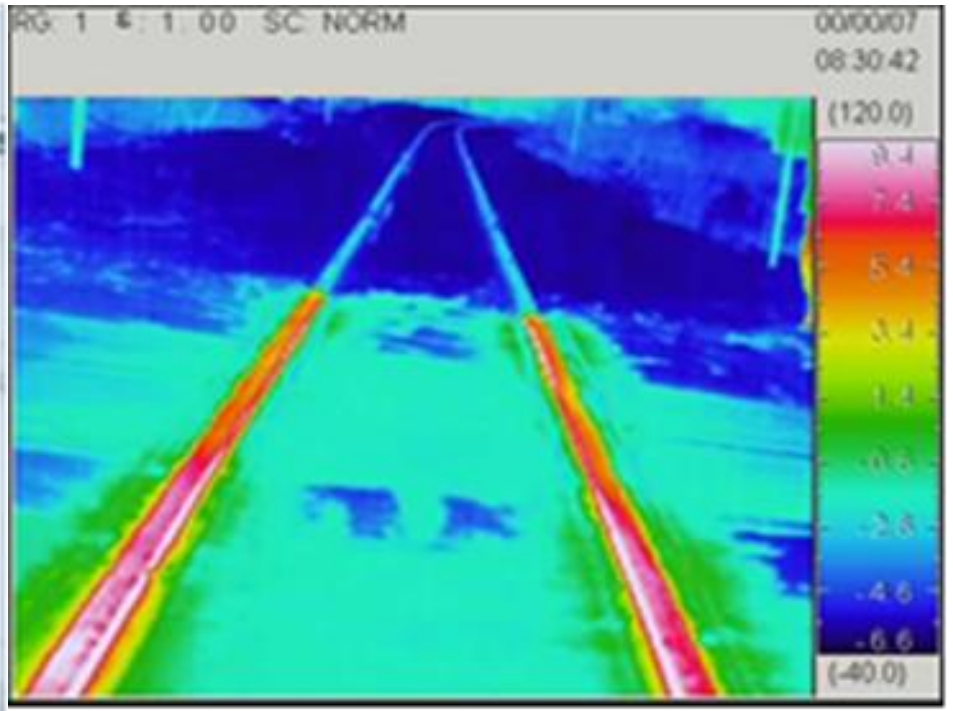


Control box

Heater

Installation of new heater

Temperature of rail at level crossing: 12.0 C°
Temperature of rail outside level crossing: -7.5 C°
Temperature of cover: 2.0 C°
Outside air temperature: -4.0 C°



(a) Visible image (b) Thermometer

Level crossing with new heater

Conclusion

Countermeasures for derailment

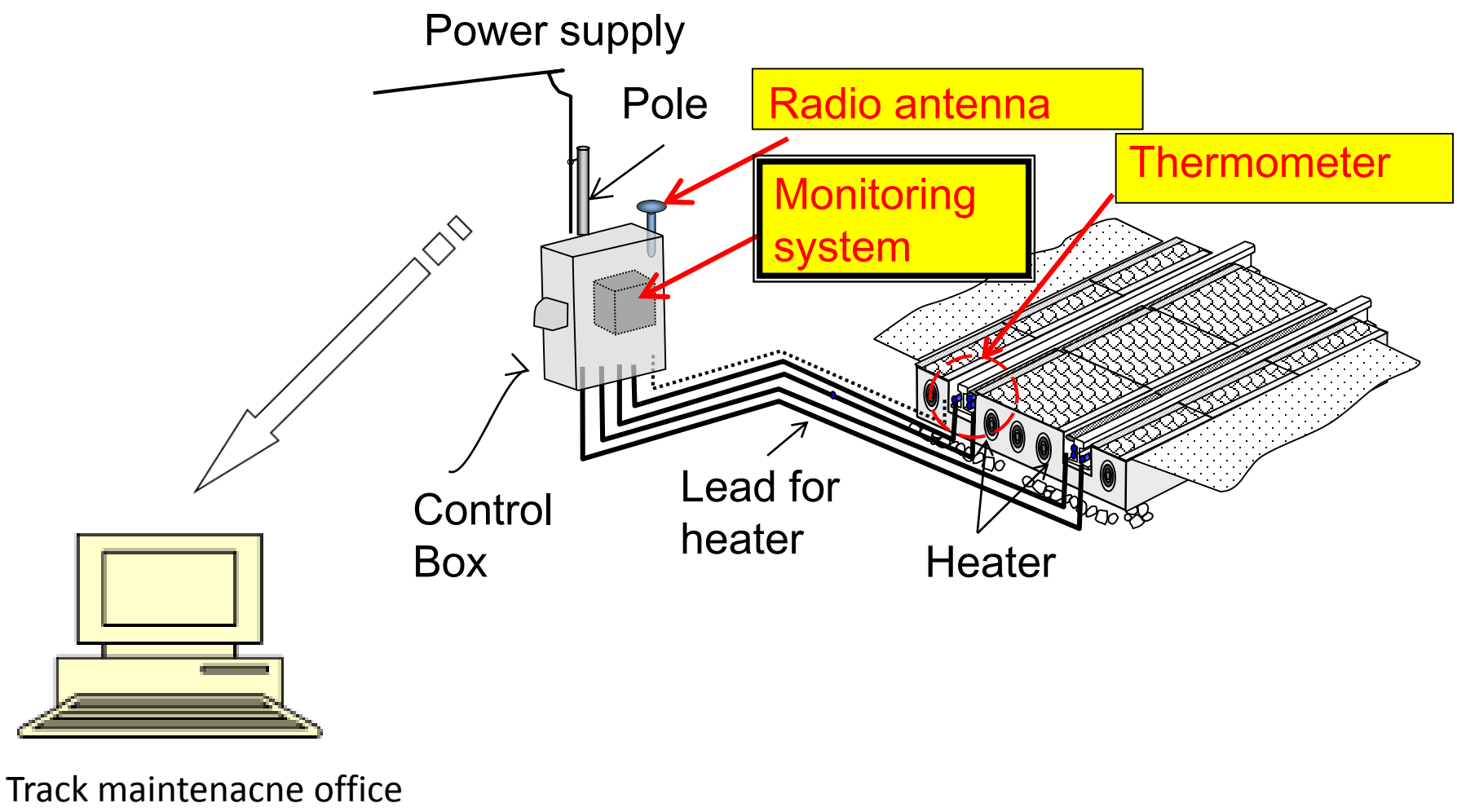
- We developed a new low-cost heater to melt snow in the flange way .
- These heaters are placed along rails in level crossing, saving installation expense.

⇒We confirmed its function for melting snow, thus introduced this type of heater as a countermeasures for derailing accidents.

Future works

Rules for resuming train operation will be changed.
That is, to monitor the heater situation following a prolonged period of non-operation.
We are now developing a heater monitoring system.

Heater monitoring system



Thank you for your kind attention.