

# Trains should be equipped with wind gauges

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The derailment in December of an express train on East Japan Railway Co.'s Uetsu Line in Shonai, Yamagata Prefecture, is believed to have been caused by a very localized gust of wind.

A wind gauge installed less than 1 kilometer from the accident site only recorded winds of about 72 kph at the time. But it seems that a much stronger wind, powerful enough to overturn a moving train, was blowing at the accident site itself.

One of the characteristics of strong winds is that they are greatly influenced by local weather and topography. This also makes it difficult to prevent wind-related disasters.

After all, wind gauges are not installed everywhere. Whenever wind-related accidents occur, the absence of data to show the actual wind velocity at the specific time and place of the accident always presents a problem. This time is no exception, with a lack of data likely to stand in the way of clarifying the accident's cause.

In the Great Hanshin Earthquake of January 1995, the ground motions were recorded at various places throughout the epicentral area, and the data proved very useful in advancing quake-resistance measures

in general. After the earthquake, the Science and Technology Agency set up about 1,000 seismometers across the nation, which are now used for earthquake disaster mitigation programs.

Unfortunately, however, this is not the case with wind. In order to prevent wind damage, we need to learn more about what wind actually is—and for that, wind velocity must be measured.

After December's derailment, the Ministry of Land, Infrastructure and Transport instructed railway officials to identify "wind paths," areas known for the passage of strong winds. But there are few places where wind is being constantly monitored. Furthermore, tornadoes or strong gusts occur only rarely, and it is questionable whether specific dangerous locations can be pinpointed.

There have been some advances in simulation technology designed to study how wind moves over complex topographical features. But researchers have yet to develop reliable ways of predicting the time and location of strong, localized winds.

Extremely dense fixed-point observation would be needed to understand the drastic differences in wind according to location. To mon-

itor wind along railways and roads, a large number of wind gauges would have to be installed. The cost would be huge.

So, as a way to complement wind measurement and reduce the risk of derailment, I propose installing measurement devices on trains.

In the 100-year history of the Uetsu Line, this is the first time a train has jumped the tracks because of strong wind.

But trains must have passed the accident site during windy conditions on countless occasions before. If trains are equipped with devices to measure rolling movements and wind flow, drivers can monitor the readings in real time.

They may be able to predict danger and take preventive measures against accidents.

The monitoring of moving vehicles is still rare. However, thanks to advances in sensors and computers, it is starting to become more practical. With the cooperation of Isumi Railway Co. in Chiba Prefecture, we at the University of Tokyo are measuring the swinging movement



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of trains in motion, and studying ways to use the information for disaster prevention. If trains were fitted with wind gauges, they would also be able to measure wind factors.

One of the advantages would be being able to detect abnormal movements caused by factors other than wind. Every time an accident occurs, "unexpected events" come to light. But such events, which could lead to serious accidents, may be able to be detected in advance. If the system is linked with the driver, he or she may be able to decelerate or stop the train.

Thus, the system can pave the way for new railroad safety measures.

After every major train accident, Japanese railroad engineers have learned a new lesson, and introduced new technology to improve safety. As a result, Japanese railroads are internationally recognized for their safety.

As the tragedy on the Uetsu Line showed, sharp localized gusts of wind present a very difficult safety challenge.

But I hope it will serve as an opportunity for the development of new systems to protect trains from strong winds, and thus enhance railroad safety in general.

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