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Safety Measures at Level Crossing of JR EAST

Masaya Fujita

Manager of Transport Safety Department

East Japan Railway Company

Summary

There are 6860 level crossings on the JR East area. In this paper, I describe our safety measures of the level crossings.

As safety measures at level crossings, in cooperation with local communities, JR East is working on the elimination of level crossings with the introduction of grade separated crossings, thereby integrating and reducing the number of level crossings. But, it is hard to reduce it.

To prevent such an accident in the rail crossings, it is necessary to first implement measures by hardware are working on following measures.

Moreover, we are promoting level crossing zero accident campaigns to ask for the cooperation of pedestrians and automobile drivers in accident prevention at level crossings.

1. Present status of level crossings of JR EAST

(1) Types and number of level crossings (Class 1, Class 3, Class 4)

There were 8358 level crossings when JR EAST was established in 1987. The basic safety measures at level crossings is the elimination of level crossings, and the number of level crossings was reduced to 6860 as of March 2017 as a result of the promotion of continuous grade separated crossings, as well as the elimination and consolidation of neighboring level crossings by holding consultations with local government bodies.

There are three types of level crossings.

- >Class 1 level crossing: Level crossings with crossing gates and alarms
- >Class 3 level crossing: Level crossings with only alarms
- >Class 4 level crossing: Level crossings without crossing gates or alarms



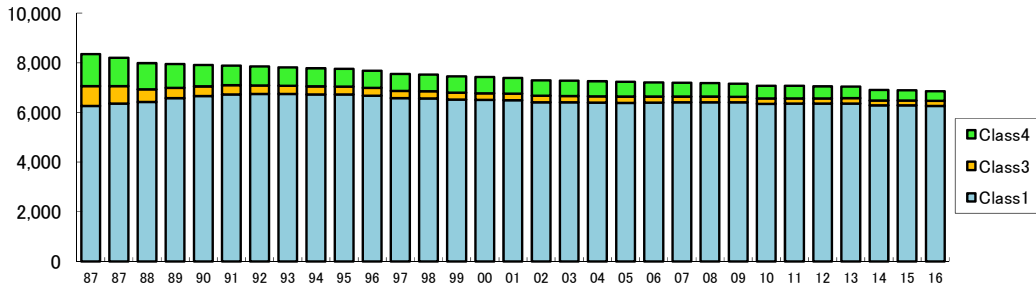
Photo 1: Class 1 level crossing



Photo 2: Class 3 level crossing



Photo 3: Class 4 level crossing

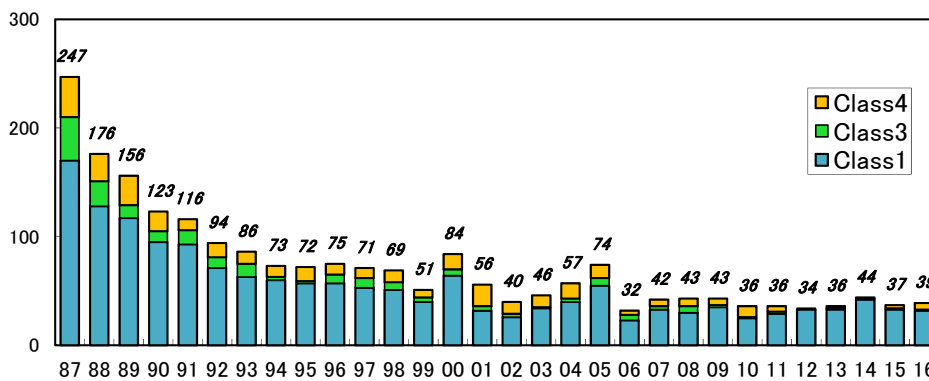


Graph 1: Transition of number of level crossings (Class 1, Class 3 and Class 4)

The bullet train (*Shinkansen*) has no level crossings; thus, the following description refers to conventional lines.

(2) Transition of number of accidents at level crossings*

In FY1987, JR EAST recorded 247 accidents at level crossings but the number of accidents was reduced to 39 in FY2016. In FY2016, 32 accidents occurred at Class 1 level crossings, 1 at Class 3 level crossings, and 6 at Class 4 level crossings.



Graph 2: Number of accidents at level crossings (Class 1, Class 3 and Class 4)

* Accidents at level crossings: People or automobiles being hit by trains



(3) Analysis of occurrences of railway accidents

The comparison of the number of railway accidents per level crossing by type shows that the number of Class 1 and Class 3 is almost the same but the number of Class 4 is large.

	Accidents at level crossings	Number of level crossings	Number of accidents per level crossing
Class 1	32	6,264	0.0051
Class 3	1	200	0.0050
Class 4	6	396	0.0152

Table 1: The number of accidents at level crossings per level crossing.

By accident occurrence factor, the crossing immediately prior to the passing of trains makes up 70% or more.

2. Countermeasures

JR EAST has taken measures to prevent accidents at level crossings. The following is an explanation of specific measures that JR EAST is taking.

(1) Crossing gate that bends outside

If automobiles or pedestrians are stalled on a level crossing, the crossing gate will bend when pushed outside to facilitate evacuation. It is indicated that they must push the crossing gate outside to evacuate when stuck on a level crossing.



Photo 4: How the crossing gate bends

(2) Level crossing warning systems

Automobile drivers or pedestrians can notify trains of danger by using the system (apply the emergency push button) when they are stuck on level crossings.

By operating this system, the obstruction warning signal installed along the track is activated to transmit a stop signal to the train. The driver confirms the signal and stops the train.

The system is installed at about 70% of level crossings (at 4,597 sites) out of 6,264 Class 1 level crossings in the JR EAST service area.



Photo 5: Appearance of level crossing warning systems (Emergency push button)



Photo 6: Obstruction warning signal

In order for this system to function effectively, the emergency push button must be pressed by a person that has confirmed an abnormality in the level crossing. A high-luminance reflector is used on the surface panel of the level crossing emergency push button to enhance the visibility, and English notations as well as symbols are used so that foreigners and children can use the system.



Photo 7: Button with improved visibility

(3) Obstacle detectors

The detectors notify trains of danger by detecting a stalled automobile or an obstacle on a level crossing.

JR EAST has introduced the following two types of detection systems.

[1] Optical system

The system uses infrared rays and laser lights to detect obstacles such as automobiles at the level crossing. An obstacle such as an automobile in the level crossing can be detected by a light emitter and a light receiver installed as a set because infrared rays and laser lights cannot reach the light receiver.

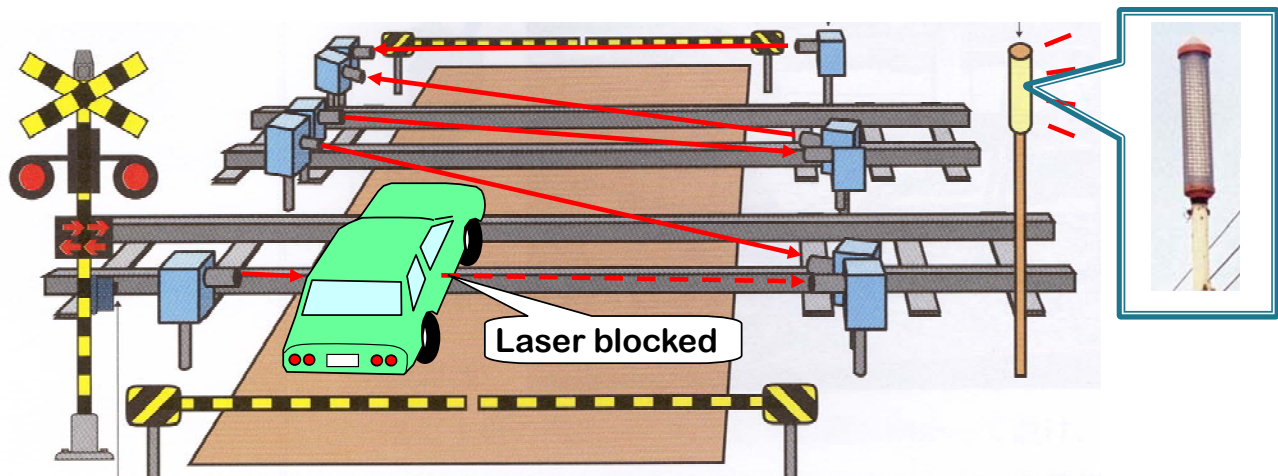


Figure 1: Operational schematic diagram of obstacle detector



Photo 8: Light emitter and light receiver

[2] Three-dimensional laser radar type

The system emits the laser light from the laser head installed in the level crossing and performs scanning within the level crossing to judge the location and size of an object in three dimensions and determine the presence or absence of obstacles.

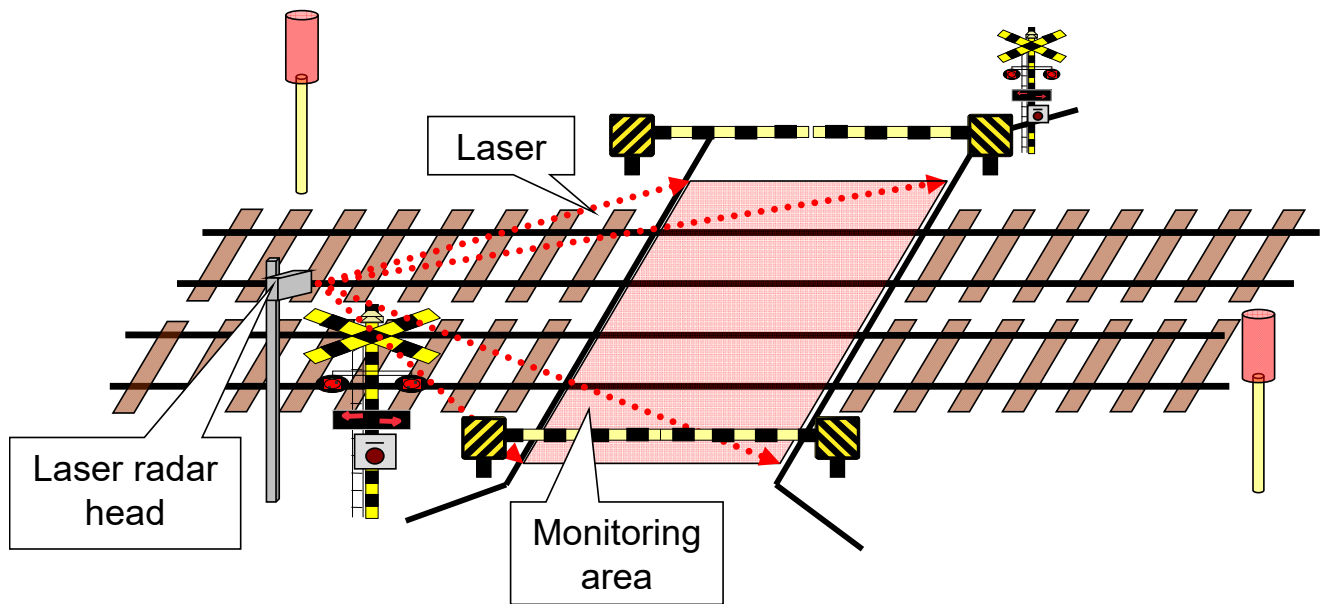


Figure 2: Operational schematic diagram of three-dimensional laser radar system

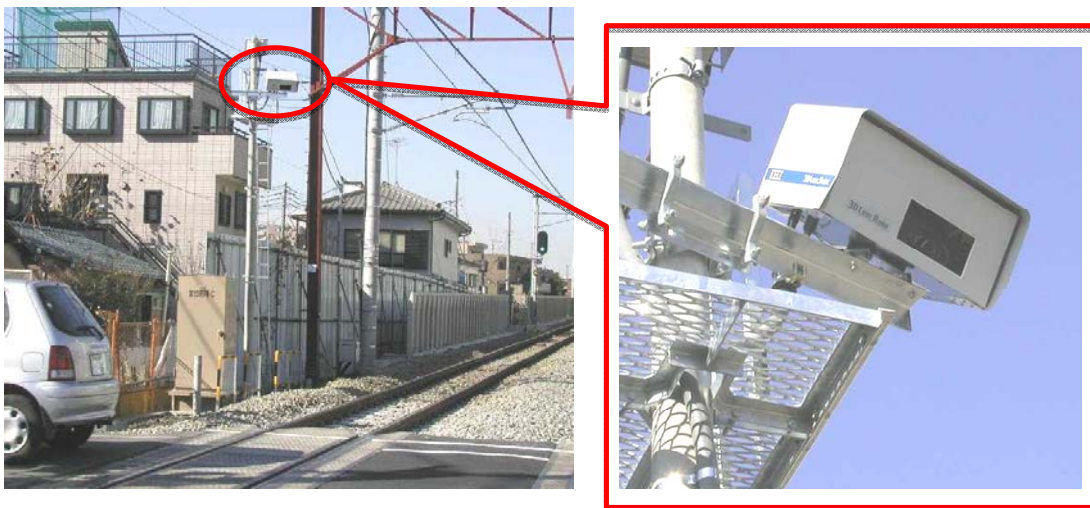


Photo 9: Three-dimensional laser radar type

(4) Measures to improve visibility at level crossings

JR East implements various measures to improve visibility at level crossings for pedestrians and automobile drivers.

[1] Overhang type alarm

By installing alarms at a higher position, level crossings become more visible to pedestrians and drivers.



Photo 10: Overhang type alarm

[2] Omni-directional type alarm

Conventionally, it was difficult to recognize the red lamp of alarms from the level crossings and the side. We are promoting alarms whose red lamp is visible from all directions.



Photo11: Omni-directional type alarm

(5) Measures for Class 4 level crossings

We eliminate and consolidate Class 4 level crossings without alarms and crossing gates and replace them with Class 1 level crossings with the understanding of local people.

The following measures are taken with respect to the level crossings that must be left as Class 4 level crossings.

[1] Solar-powered illuminated signs

Since Class 4 level crossings are installed in suburbs in many cases the surroundings are dark at night, there was a problem that the level crossings are difficult to recognize. To solve this problem, we have installed solar-powered illuminated signs that store electric power generated by solar batteries and illuminate the LEDs at night so that pedestrians can easily recognize the existence of level crossings.



Photo12: Solar-powered illuminated signs

[2] Implementation of air whistle

Most accidents at Class 4 level crossings occurred when pedestrians crossed immediately in front of the trains. In response to this, an air whistle is blown to help pedestrians notice the approaching train.

3. Risk communication

To prevent accidents at level crossings, in addition to implementing measures as a railway operator, it is necessary to remind pedestrians to cross the level crossing safely and use the emergency push button in the case that any abnormality is found. Accordingly, we are promoting the following activities:

(1) Level crossing zero accident campaigns

To ask our customers to cooperate in the safe use of level crossings, we post posters at stations and conduct activities in cooperation with local police stations.



Photo13: Awareness raising activity at level crossings

(2) Hands-on campaign of level crossing warning systems

We have developed a simulator of the level crossing warning system and have the licensing center install it so that participants can experience a simulation of the operation. In addition, we are promoting active learning programs at local events and stations.



Photo14: Scene of event

(3) TV and radio commercials

Many elderly people are involved in accidents at level crossings. We are broadcasting TV and radio commercials targeting elderly people.



Photo 15: Scene of TV commercial

Conclusion

In order to reduce the level crossing accident, we have taken countermeasures from both aspects of hardware and software that I have explained in this paper. As a result, we were able to reduce the number of accidents to about one sixth of that at the time the company was inaugurated.

However, the number of accidents has not stopped declining for about 10 years.

We will work on further reduction of accidents at level crossings.