

# TRAIN APPROACH ALARM FOR LINES WITHOUT TRACK CIRCUITS

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## SUMMARY

Safety Research Laboratory which I belong. Our aim is reducing the number of passenger injury and death to zero, also the employees including subcontract death to zero. Therefore, It's very important to improve environment of our railway construction more safety. So, JR-East develops new train approach warning system to assist train watchman. As follow, I describe the plan and mechanism of this system.

## INTRODUCTION

Railway construction which is located on the track and the periphery, we perform line-closure procedures by red signal to prevent train enter the block. In the case of easy work such as surveys, we put train watchman instead of performing line-closure. In this case, safety of worker depends on only their attentiveness.

Accordingly, JR-East developed TC-type train approach warning system (hereinafter "TC alarm") for improving the construction safety, and we introduced in target line since fiscal 1998. We use truck circuit for TC alarm to detect train location. Therefore, this system didn't spread to provincial lines which don't have truck circuit.

Now, we introduce TC alarm about 75% of conventional lines. But remaining 25% lines can't use TC alarm because of lack of truck circuit.

The incidence of the case which worker fail to evacuate, it is five times more likely to use TC alarm than to depend on only watchman.

Therefore, we developed new train approach warning system with GPS location technology, which is usable even in the lines without truck circuit.

## DEVELOPMENT OF A TRAIN APPROACH ALARM FOR LINES WITHOUT TRACK CIRCUITS

In this system, the location of the train and the workers is identified by GPS, and it is transmitted by mobile phone line.

Alarm terminal calculates the distance between train and workers. When a train comes close to workers, the alarm terminal gives warning with alarm and vibration.

This alarm terminal works with smartphone, installed a dedicated application. So, it's convenient to carry. And alarm terminal displays some information, such as train numbers, location, delay time if any, approaching distance, and train velocity.

In addition, TC alarm sometimes warns long time more than necessary, because it uses long distance track circuit for detecting trains. In this case, workers come into the truck wrongly, so it's very hazardous. On the other hand, new system can calculates accurate distance between a train and workers by GPS. So, it's effective more than existing TC alarm.

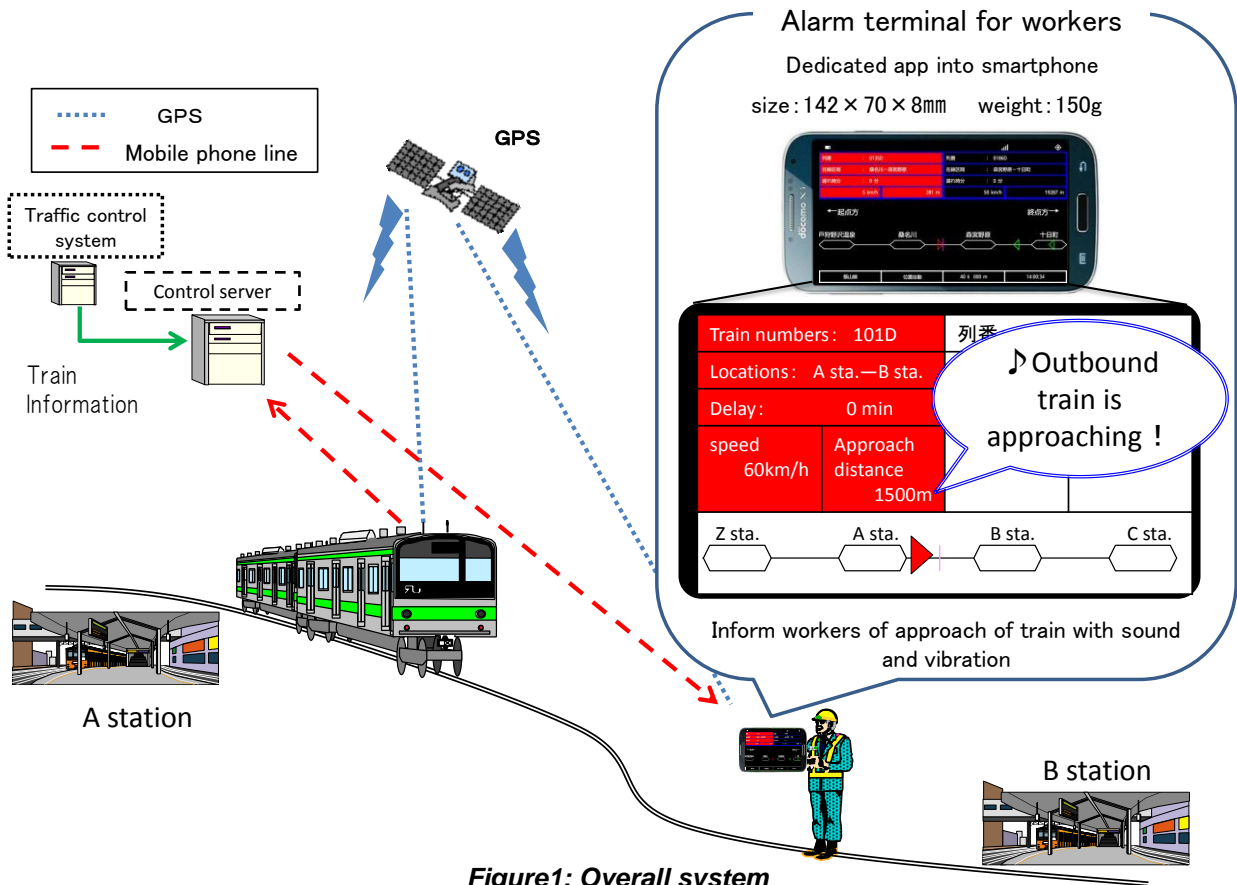
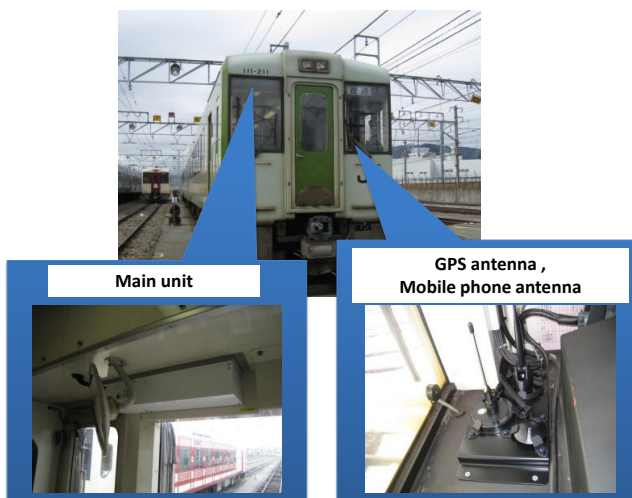


Fig2 is an onboard system.

GPS antenna and mobile phone antenna are located in front of the driver seat. The main control unit of onboard system is located beside of the driver seat.

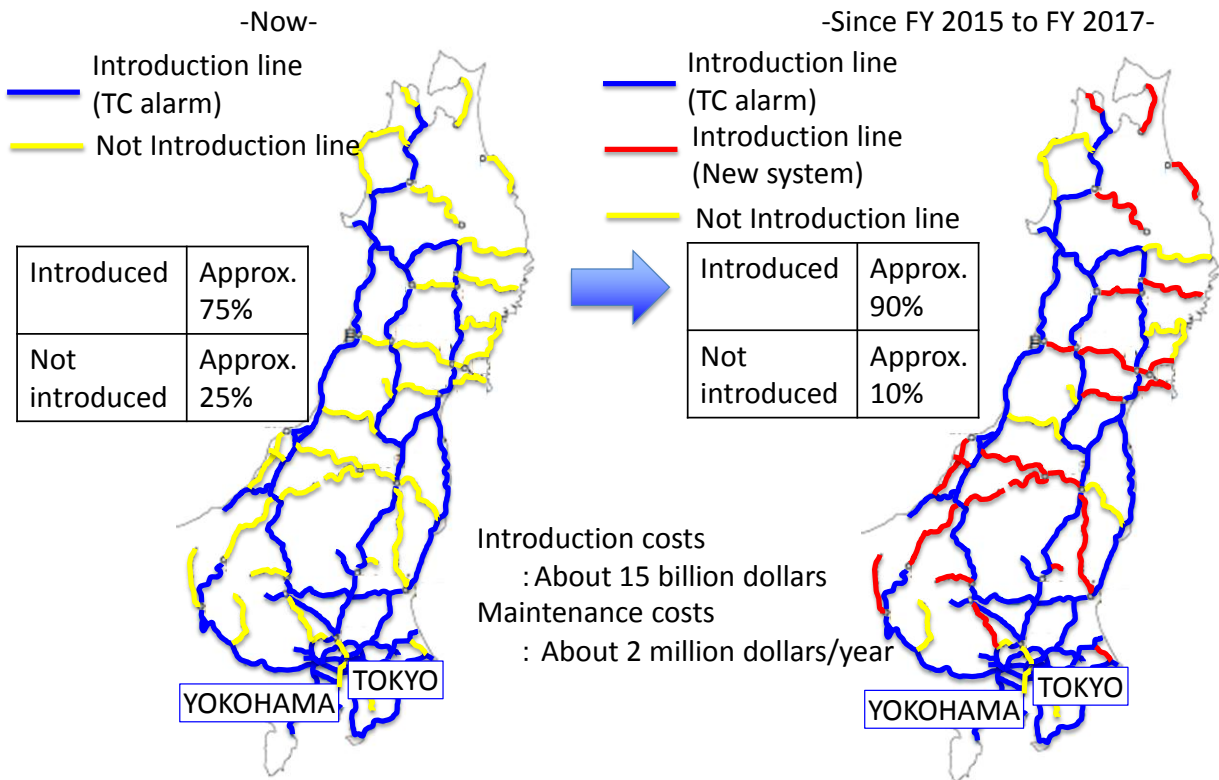
Fig3 is an alarm terminal for workers.

Workers bring alarm terminal, and when a train come within 3000m from workers, alarm terminal makes alarm with yellow light, sounds, and vibration. And also within 1500m, this alarm light changes yellow to red, and sounds become more loudly. After a train 100m pass away, alarm ends.



By the end of fiscal 2017, we plan to spread this new system into 25 lines without truck circuit. It costs about 15million dollars and its running cost is 2million dollars per year.

In 2017, the rate of introducing the train approach warning system will increase by 90%. In the years come, we try to develop next system for remaining 10% lines which don't have train information device.



**Figure 4: Future plans of a train approach warning system**

EXAMPLE OF THE USE OF GPS INFORMATION TO OTHER SYSTEMS IN RAILWAY

As above, we explained new train approach warning system. GPS location technology is use for various railway service. For example, train information service for passenger, which includes train location, train numbers, on time or delay, and congestion situation on the internet. The freight location system shows the location and on time or delay to customers.

CONCLUSION

- 1) JR-East develops new train approach warning system with GPS location technology, which is usable even in the lines without truck circuit. So, we improve safety of railway construction.
- 2) The alarm terminal works with smartphone, installed a dedicated application. So, it's convenient to carry.
- 3) The alarm terminal makes alarm with sounds, and vibration when a train arrives.
- 4) And also alarm terminal displays some information, such as train numbers, location, delay time if any, approaching distance, and train velocity.
- 5) By the end of fiscal 2017, we plan to spread this new system into 25 lines. The rate of introducing the train approach alarm system will increase by 90%.