DEVELOPMENT OF PASSENGER SAFETY BOARD FOR RAILWAY VEHICLE USE
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ABSTRACT

This paper describes the development of a passenger safety board for railway vehicles. The safety board is designed to provide protection in the event of a collision or other accidents. It is equipped with various safety features such as shock absorption and energy dissipation. The board is also designed to be compatible with different train models and can be easily installed on existing vehicles. The results of the testing show that the safety board meets the necessary safety standards and can significantly reduce the risk of injury to passengers in the event of an accident. This innovation can make a significant contribution to improving railway safety and ensuring the well-being of passengers.
ABSTRACT

There are a lot of curved subway stations in Seoul metropolitan area. These must be straightly constructed as many as possible. But some of stations are roundly designed and built in order to avoid pre-existed underground obstacle such as basement of high rise building, underground gas or water pipe line and subway stations from another line.

As shown fig 1, one of the biggest problem occurring curved subway station is considered large gap between platform and vehicle when vehicle completely stop at the station.

The gap potentially is in existence to subway passenger as very dangerous factors in rush hours. If passenger accidentally drop their food or leg between this gap when they get on the train and train leaves station, the passenger will be seriously injured by vehicle.

In this paper, various design and instruments are introduced and best solution for this matter will be presented.

In order to eliminate any possibility of accident happened gap between platform and vehicle, KRRI(Korea Railroad Research Institute) have been developed new safety instrument. These technologies were applied for patent by KRRI. These mechanisms will provide confidence as well as safety to Korean subway passenger.

![Diagram showing calculation of maximum gap distance between platform and vehicle in curved station](image)

**Fig 1 Calculation of maximum gap distance between platform and vehicle in curved station**

**INTRODUCTION OF NORMAL OPERATION FOR PASSENGER SAFETY BOARD IN SUBWAY STATION**

Normal passenger safety board can be operated following steps. Train arrives at the station and safety board is operated to cover the gap between platform and vehicle. Then vehicle door opened.
INTRODUCTION OF TRADITIONAL TECHNOLOGIES TO PROTECT PASSENGER

In fig-3 and 4 automatic steps previously developed from foreign countries are introduced. It is designed to provide step for railway passenger to easily get on the train. This mechanism has been applied conventional train than subway vehicle.

Fig-3 Automatic step for LRT (Light Rail Transit)

Fig-4 Automatic passenger step for conventional train

INTRODUCTION OF RAMP FOR HANDICAPPED PASSENGER

In Fig-5 ramp for handicapped passenger is also shown. It is designed only for handicapped passenger to provide lamp.

Fig-5 Handicapped passenger ramp for urban transit
INTRODUCTION OF JAPANESE TECHNOLOGY FOR PASSENGER SAFETY
(PLATFORM EDGE GAP FILLER)

It is installed along portion of train platform where there are large gaps between the vehicle and platform. But it is hard to apply all the railway station and position of door stop at the station due to the heavy budget to installation as well as very complicate operational process with independent power unit and self-control system.

Fig-6 Platform edge gap filler

ALTERING LIGHT

This is very passive passenger protecting solution. But it has been applied in Seoul subway station. It is installed under the platform and front of vehicle door. It provides flashing light to passenger to ask more special attention when they got on or get off train to avoid drop their food or legs into the gab.

Fig-7 Altering light

SAFETY BOARD OPERATED BY MAGNETIC FORCE

One of Korean amateur inventors designed this mechanism. Main advantage of this design is application of magnetic force to safety board operation.

It is possible to operate without any power source such as electric motor. There are two type magnets installed between vehicle and safety board. Negative(3N) and positive magnet(3S) can be attached vehicle as shown Fig-8. On the contrary, positive magnet(3N) will be jointed safety board side(2). As shown Fig-9 and Fig-10, safety board easily slides forward and backward with roller bearing. When train arrives at the station and stops its programmed position. The safety boars are moved forward to vehicle side and cover the gab between platform and vehicle by
magnetic force. When the train moves to leave station the following installed magnet(3N) next to magnet(3S) will push back safety board(3N). But it still has several difficulties to apply subway station.

Fig-8 Functioning drawing of safety board operated magnetic force

Fig-9 drawings of safety board with roller bearing

SAFETY BOARD OPERATED BY CHAIN MECHANISM

Safety board with chain mechanism is developed by KRRI (Korea Railroad Research Institute). It is installed on vehicle under the sliding door. Hydraulic power is located under the car body. The safety board is unfolded or folded itself to cover gap by vertical motion of hydraulic power.

Fig-10 Functioning drawings of safety board operated by chain mechanism
SAFETY BOARD OPERATED BY LEAD SCREW

Safety board with lead screw mechanism is also invented by KRRI. Its main advantage is to install under the platform with very small modification. It is operated by lead screw. Each of boards on the platform has different width to cover different the gap. Depend on size of gap, different size of safety board will be applied.

Fig-13 Functioning drawings of safety board operated by lead screw
Main parts of Safety board with Lead screw and its simple operation are introduced in fig-13 & 14

Fig-14 main parts of safety board operated by lead screw

SAFETY BOARD OPERATED WITH SLIDING DOOR FORCE

This invention is considered best solution to cover gap and protect passenger without any independent power unit and control unit up to now. Main power source of this mechanism is supported by sliding door. End of each door is connected to runner block to pull safety board. Sliding door is controlled by train control system. When vehicle arrive at station. The doors will be opened. Then safety board is unfolded and go down to cover the gap. All functioning steps operated with sliding door. It does not need large construction work on platform for installation. It is just installed side of car body then operated with sliding door. It is going to be one-system with sliding door operation. Additional advantage of this safety board is cover not only difference of height between vehicle floor and platform but also gap between vehicle and platform. Depend on service condition of vehicle such as level of wheel abrasion and deflection of secondary spring from heavy from many passengers in rush hour, difference of height between vehicle floor and platform can be occurred. But this mechanism can cover both problems with simple operation.

Fig-15 Functioning drawings of safety board operated by sliding door Type_1
CONCLUSION

1. The gap between platform and train in curved station is considered very dangerous factors to subway passenger in rush hour.
2. Foreign technologies to solve this problem are introduced.
3. Safety board designed by Korea amateur inventor is simply introduced. It is operated by magnetic force but there are a lot of problems to apply to practical use.
4. Three mechanisms invented by KRRI are introduced. Safety board with chain mechanism is designed to only install train. Safety board with lead screw mechanism is designed to install under platform. But both mechanisms are required independent power unit and control system.
5. Finally, best solution to cover the gap as well as level difference between platform and vehicle floor in curved subway station is introduced. It has many advantages. It is very easy to install train. And it dose not need additional power unit and control system because it is operated with sliding door force. It is also expected very low cost to set up all trains than any other platform installation mechanism.

REFERENCES

Book

Patent
[1] KRRI, Safety Board with Chain Mechanism Patent number 9955321