

# Development of the Vehicle Barrier Preventing Pedal Error Crashes

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Recently, car crash accidents due to pedal error are increased and become a big social problem. Pedal error crashes often happen in parking lots. In the case of such accidents, the vehicle often plunges into a building and injures surrounding people.

Vehicle barriers and parking bollards are effective measures against such accidents. However, general hooped barriers are to deter vehicles from entering the area. Therefore, vehicles hit the hooped barriers and bend the base of them or dig up the foundation concrete block. On the other hand, the so-called H-type bollard as an impact-resistant bollard that resists vehicle collisions and prevents vehicle entry needs a large foundation concrete block and heavy equipment to install it.

Our group developed new vehicle barriers to reduce the damage to buildings and surrounding people from crashes caused by pedal error. These vehicle barriers can install easily and do not require the foundation concrete block and heavy equipment. The vehicle barriers we developed are shown in Fig. 1. One is a foldable type and the other is a fixed type vehicle barrier. This foldable vehicle barrier uses a parallel link mechanism. It stands upright and acts as a marker for parking in normal conditions. When a vehicle hits the vehicle barrier, it becomes a slope by falling down and stops the vehicle from running onto the slope. The fixed-type vehicle barrier is designed to reduce costs and improve strength by removing foldable mechanisms from the foldable vehicle barriers. The shape of the fixed-type vehicle barrier is like a folded conventional hooped barrier. This type also stops vehicles by its slop.

Crash simulations using general-purpose finite element analysis software and crash tests simulating pedal error accidents using a real vehicle were conducted to confirm the stopping performance of the vehicle barriers. A real crash test is shown in Fig.2. The mechanism of the vehicle barriers worked properly and vehicles were stopped from running onto the vehicle barrier were confirmed. Additionally, any airbags were not deployed in the crash tests. It means that there is no significant impact on the vehicle and minimal damage to the driver.

After the test was completed, we removed the vehicle barrier and checked the installation hole and surroundings. No damage was observed to the surrounding ground and the hole.

In the future, we improve the performance of these vehicle barriers through further crash simulations and real crash tests and identify long-term use issues of them to put them into practical use.



Foldable vehicle barrier

Fixed type vehicle barrier

**Fig. 1** Two types of vehicle barriers we developed



**Fig. 2** A crash test of the fixed type vehicle barrier