

A Review of Regulatory Status and Standards of Physical Barriers Against Explosives and Vehicle-ramming Attacks

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Introduction

Background

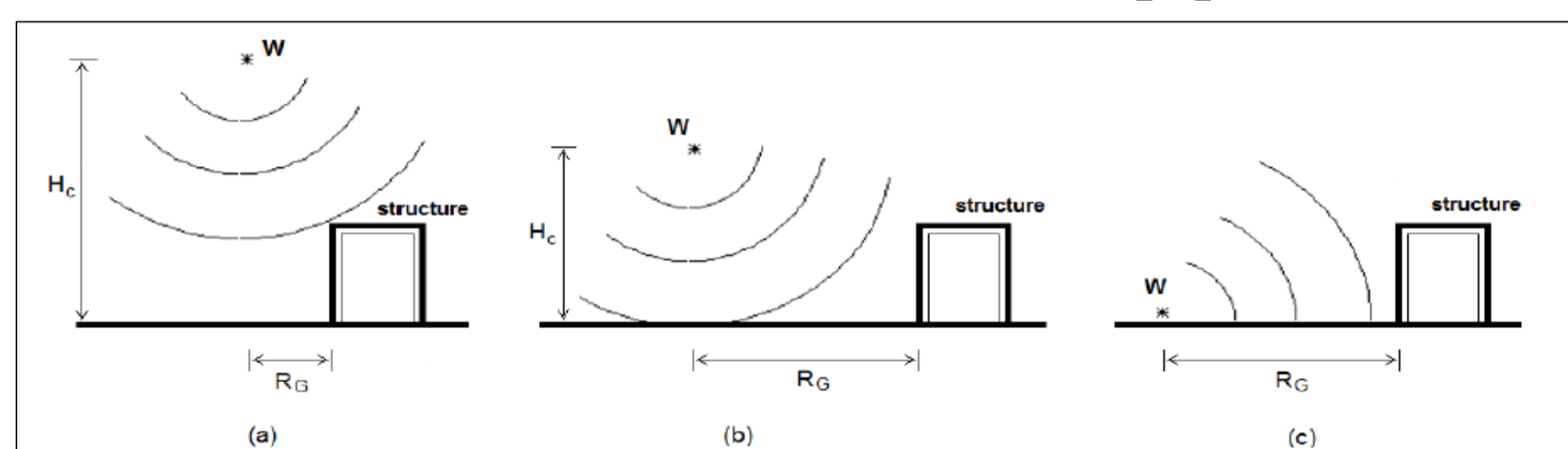
- With the advancement of terrorism technology and methods, it is necessary to establish standards for the regulation of physical barriers for nuclear power plants, which are important national facilities

Objective

- Validation of the physical barrier performance of nuclear facilities against explosives and vehicle-ramming attacks and suggestion of the direction of establishing regulatory standards
- The target of explosion-proof performance is the door and the structures around the door installed in the vital area, and the target for vehicle barriers are roadblock, barricades, and sliding doors, etc.

Explosion-proof performance regulatory trends and standards

- United States: the unified design standard UFC (Unified Facilities Criteria) 3-340-02 is applied by integrating the guidelines for explosion-proof and protection standards possessed by the Army, Navy, and Air Force based on technical document TM 5-1300 (US Army, 1990)
- In the explosion load analysis, the scaled distance Z is used as a key variable. Scaled law: $Z = R/E^{1/3}$ or $Z = R/W^{1/3}$ (Z : scaled distance, R : distance from the center of the explosive, W : total weight of standard explosives (TNT))
- For explosives other than TNT, use the TNT equivalent method.
TNT Equivalent : $W_E = \frac{H_{EXP}^d}{H_{TNT}^d} W_{EXP}$
- Depending on the location of the explosion, it can be classified into a free-air bursts, air bursts, and surface bursts [1].



Since the blast target was set as the doors of a nuclear facilities and its surrounding facilities in this study, it is necessary to consider the structure, operation, and opening/closing types of the doors.

Vehicle barrier regulatory trends and standards

- In general, the performance of vehicle barriers is evaluated using standard test methods as shown in the table below.
- Each standard test is somewhat different, and the vehicles used for performance evaluation are mainly UK, European, and USA vehicles.

Standard	Region	Purpose	Vehicle types used
ISO IWA ¹⁾ 14	Global	- International standard for impact testing and performance classification of VSBs ⁶⁾	UK, European and North American (9 vehicle type categories)
BSI PAS ²⁾ 68	UK	- Standard method for testing the impact performance and protection rating of VSBs	UK (6 vehicle type categories)
ASTM ³⁾ F2656	USA	- Impact testing and assigning performance ratings for VSBs	North American, UK, European (6 vehicle categories)
CEN CWA ⁴⁾ (Withdrawn)	Europe	- Derived from PAS 68 and PAS 69 - Guidelines for the selection, installation and use of VSBs	European (6 vehicle categories)
DoS ⁵⁾ SD-STD (Withdrawn)	USA	Forerunner of ASTM F2656	USA

- 1) International Workshop Agreement
- 2) Publicly Available Specification
- 3) American Society for Testing and Materials
- 4) CEN(European Committee for Standardization) Workshop Agreement
- 5) Department of State
- 6) Vehicle Security Barriers

Status and limitations of domestic regulatory standards

- The Korea Institute of Nuclear Safety(KINS)'s 'Regulatory Standards and Guidelines for Light-Water Nuclear Power Plants' have standards for evaluation of man-made accidents that may occur in the vicinity of nuclear facilities and regulations on flying debris and there are insufficient standards for explosives and vehicle-ramming attacks
- Since nuclear facility sabotage is likely to use an attached explosive, it is necessary to establish regulatory standards in consideration of the impact of near-field explosions through additional calculations
- Vehicles to be used for vehicle barrier performance evaluation should select Korean cars, and performance evaluation should be performed in consideration of the surrounding environment such as vehicle access roads in nuclear facilities
- Therefore, it is necessary to prepare measures to apply its own regulatory standards suitable for the domestic environment by analyzing the foreign performance standard data

Results and Discussion

- As a result of analyzing, it is necessary to supplement and establish physical barrier regulations for domestic nuclear facilities
- There are limits to the application of foreign standards to Korea as it is, it is necessary to prepare its own performance verification standards
- Therefore, we plan to study performance verification methods by referring to overseas regulatory data, and conduct data investigations on the status, manufactures, and certification bodies of physical barriers installed in domestic nuclear facilities



- Based on this, threat scenarios according to protection area will be selected and standard M&S (Modeling & Simulation) models will be developed using a numerical analysis program to analyze the conditions of explosives and vehicles that can break the barriers of current nuclear facilities and enter them
- After that, the necessary physical barrier performance conditions will be derived, and the development method, procedure, and results of these M&S models will be verified to establish the performance DB
- It is expected that it will be able to prepare its own physical barrier regulation standards in consultation with the expert council

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