

Designation: E3211 – 22

Standard Practice for Selection, Integration, and Verification of Active Vehicle Barrier Safety Devices¹

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1. Scope

1.1 This practice is intended to provide methods for selecting, integrating, and verification of active vehicle barrier safety devices so that vehicle barrier systems are reliably and safely controlled when in operation.

1.2 There are a number of risks associated with the operation and use of active vehicle barrier systems (AVBS). One of the risks is that of undesired collision between an active vehicle barrier (AVB) and an authorized vehicle. Such risks can be minimized through proper design, construction, installation, operation, and training in the use of such systems.

1.3 The proper selection, installation, and use of safety devices that will prevent an AVBS from activating or deploying while an authorized vehicle is transiting the barrier, or when such an authorized vehicle is stopped while a portion of the vehicle is located in the path of or in an unsafe proximity to a barrier, can minimize the likelihood of unintended collision between a barrier and authorized vehicle.

1.4 For this practice, safety refers to the ability of the barrier to operate without causing unintended damage to vehicles or injury to people via operation or deployment of the barrier, when an authorized vehicle is transiting the barrier. Security refers to the ability to operate or deploy the barrier to serve its intended purpose of stopping an unauthorized vehicle from passing through the barrier location.

1.5 Pedestrians are excluded from the scope of this practice. It is assumed, for the purposes of this practice, that pedestrians are excluded from potentially hazardous locations in the immediate vicinity of AVBS moving components. It is recognized that authorized pedestrians may be present in the area of the movable AVBS for required purposes, such as inspection of vehicles that are stopped. The presence of "casual" pedestrians shall be kept away from the movable elements of the AVBS.

1.6 This practice is not intended to address any of the following:

1.6.1 Overall performance of vehicle barrier systems or effectiveness as a barrier against any vehicles (see Test Method F2656/F2656M).

1.6.2 Impact energy able to be withstood by vehicle barrier systems.

1.6.3 Serviceability of barrier systems.

1.6.4 Selection of vehicle barrier systems for any particular use.

1.6.5 *Pedestrian Detection Safety Devices*—This practice considers that pedestrians are excluded from hazard zones in the vicinity of vehicle barrier systems; and that only trained and authorized people, such as maintenance staff and security officers performing necessary functions, will be present in the hazard areas when the active barriers are in operation.

1.6.6 Design and installation of vehicle barrier systems, other than performance of associated vehicle detection safety devices, and the verification that safety devices are able to be overridden under designated emergency conditions, as required by owners.

1.6.7 Operating procedures or instructions for operational use of active vehicle barrier systems once they are installed and placed into service. Although such operating procedures are essential for the safe operation of AVBS in practice, development and implementation of such procedures is beyond the scope of this practice.

1.7 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.8 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the

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Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

F2200 Specification for Automated Vehicular Gate Construction

F2656/F2656M Test Method for Crash Testing of Vehicle Security Barriers

2.2 ANSI/UL Standard:³

ANSI/UL 325 Standard for Safety – Door, Drapery, Gate, Louver, and Window Operators and Systems

2.3 ASHRAE Standard:⁴

Guideline 0 "The Commissioning Process."

2.4 IMSA Standards:⁵

Specification 50-2 Polyethylene insulated, polyethylene jacketed, loop detector lead-in cable

Specification 51-1 Polyvinyl chloride insulated, nylon jacketed loop detector wire

Specification 51-3 Cross linked polyethylene insulated loop detector wire

Specification 51-5 Polyvinyl chloride insulated, nylon jacketed, loosely encased in a polyvinyl chloride or a polyethylene tube loop detector wire

Specification 51-7 Cross linked polyethylene insulated loosely encased in a polyvinyl chloride or a polyethylene tube loop detector wire

2.5 NFPA Standard:⁶

NFPA 70 National Electric Code (NEC)

3. Terminology

3.1 *Definitions:*

3.1.1 *active vehicle barrier, AVB, n*—mechanized and controlled barrier that is capable of stopping a moving vehicle, automatically or manually operated to place or remove an obstruction in the path of a vehicle to prevent such vehicle from passing through the barrier when the lane is closed.

3.1.2 active vehicle barrier system, AVBS, n—mechanized system, complete with all associated controls and devices that may be installed in the factory or in the field to effect operation of an active vehicle barrier in its installed configuration, to either permit or deny access by automobiles, trucks, or similar transportation equipment; active vehicle barrier system includes an active vehicle barrier along with controls and other devices that may be necessary to operate the barrier in practice.

⁶ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, http://www.nfpa.org.

3.1.3 agency, n-specifier, responsible party, or owner.

3.1.4 *basis of design, BOD, n*—documentation of the primary decision-making process and assumptions behind design decisions made by the responsible designer to meet the Owner's Project Requirements.

3.1.4.1 *Discussion*—Consult ASHRAE Guideline 0 for additional information regarding basis of design and commissioning.

3.1.5 *bollard*, *n*—vertical post or series of posts used to channel or restrict vehicular traffic.

3.1.5.1 *Discussion*—Bollards used for vehicle control are usually steel, concrete, or a combination of multiple materials. Bollards may be fixed-in-place, removable, or actively controlled operable/retractable. This practice is concerned primarily with those that are actively controlled to allow or restrict passage of vehicles through a portal or access point.

3.1.6 *condition designation*, *n*—relates vehicle type and vehicle velocity to the kinetic energy for which testing is conducted.

3.1.7 *confidence interval*, *n*—range of values that may include the true value of a parameter of interest, such as the probability that a barrier will prevent access to an unauthorized vehicle.

3.1.8 *confidence level, n*—probability value associated with a confidence interval; the percentage of times that the confidence interval can be expected to include the true population parameter in the long run.

3.1.9 *continuous barrier, n*—any perimeter barrier that relies on a continuous foundation or a continuous structural element to resist penetration by vehicles.

3.1.10 *hazard zone, n*—area in and around the moving components of an active vehicle barrier (AVB) assembly and associated moving elements system in which significant potential for impact or collision exists.

3.1.10.1 *Discussion*—Extent or boundaries of hazard zones may be different under different circumstances or operating conditions. For example, if an active vehicle barrier system (AVBS) and associated moving control components, such as control arms or gates, are used only in an area in which vehicles are stopped, checked, or verified and then permitted to pass through the barrier system at low speed after the access control point is opened, then the hazard zone may only extend a short distance beyond the actual moving components of the system. If, however, the AVB is used in a different manner, such that it is normally retracted (open) and closed to prevent a vehicle that may be moving at a higher speed from passing the control point upon detection of a threat condition, then the hazard zone may be much larger—and dependent on the approach distance and speed of the vehicle.

3.1.11 *interposing relay, n*—electrical control device between two systems that enables one system to connect to—or control—a second electrical circuit while retaining direct electrical isolation between the two systems.

3.1.11.1 *Discussion*—Typically used to control a high-power device or circuit from a low-power control signal.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

⁴ Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, http://www.ashrae.org.

⁵ Available from the International Municipal Signal Association, 597 Haverty Court, Suite 100 - Rockledge, FL 32955.

3.1.12 *lower confidence bound*, *n*—lowest value of a onesided confidence interval; in the context of this practice, the lower confidence bound indicates belief that the estimated probability of success is at least as good as this value, at the confidence level employed, given the test results.

3.1.13 *lower confidence limit, n*—lowest value of a twosided confidence interval; in the context of this practice, the lower confidence limit indicates belief that the estimated probability that the barrier system will operate as intended is at least as good as this value, at the confidence level employed, given the test results.

3.1.14 *override*, n—type of control in which a system or person can supersede a function or operation.

3.1.14.1 *Discussion*—For example, an override switch that would enable an operator to cause a barrier to be deployed regardless of the inhibiting status of an automatic safety device or a manual disable control that disables movement of an AVB could both be considered override controls.

3.1.15 *override*, *v*—control action taken by an operator or another system to supersede a function or operation.

3.1.16 *owner's project requirements, OPR, n*—written documentation of the functional requirements of the facility or system and the expectations of how it will be used and operated.

3.1.16.1 *Discussion*—Term is from ASHRAE Guideline 0. The owner is not always the end user or operator of a system. In many cases, the owner may be responsible for providing a facility or system to meet end-user or other agency's requirements. For example, within the U.S. Government, one agency (such as the General Services Administration) may be considered to be the owner, but another agency (tenant agency or other end-user organization) may have actually determined the functional requirements of the facility or system.

3.1.17 *rated barrier*, *n*—vehicle security barrier tested in accordance with Test Method F2656/F2656M by an accredited facility that achieves a given condition designation and penetration rating based on the distance traveled after impact.

3.1.18 *responsible authority, RA, n*—person responsible for some aspect of requirements for this practice.

3.1.18.1 *Discussion*—Responsible authority has responsibility for some aspect of the AVB equipment or system that is the subject of this practice. Responsible authority may—or may not—be different than authority having jurisdiction (AHJ). For example, the engineer of record (EOR) may be the responsible authority for technical design of the AVBS, but the responsible authority for determining owner's requirements for AVBS that the equipment or system is designed to meet may be someone other than the EOR. Contracting officer is typically the responsible authority for contract matters.

3.1.19 sequence of operations, SOO, *n*—written narrative describing control order and action of how a system responds to a set of stimulating conditions or commands.

3.1.20 *supplier*, *n*—manufacturer, distributor, designer, or constructor of the barrier system that is to be tested; can include contractors, engineers, and architects.

3.1.21 *test director*, *n*—employee of the testing entity, commissioning agent, third-party testing firm, contractor, or other entity responsible for all aspects of a test.

3.1.22 *tester*, *n*—person actually performing or controlling tests in the field.

3.1.23 *test vehicle, n*—designated vehicle for specific barrier operation testing.

3.1.24 *upper confidence limit, n*—highest value of a twosided confidence interval; in the context of this practice, the upper confidence limit indicates belief that the estimated probability that the barrier system operates as intended is no better than this value, at the confidence level employed, given the test results.

3.2 Acronyms:

3.2.1 AHJ-Authority Having Jurisdiction

3.2.2 *ASHRAE*—American Society of Heating, Refrigerating and Air Conditioning Engineers

3.2.3 AVB-Active Vehicle Barrier

3.2.4 AVBS—Active Vehicle Barrier System

3.2.5 BOD—Basis of Design

3.2.6 *CL*—Confidence Level

3.2.7 EOR-Engineer of Record

3.2.8 GSA—General Services Administration

3.2.9 IMSA-International Municipal Signal Association

3.2.10 ISO-International Standards Organization

3.2.11 LCB-Lower Confidence Bound

3.2.12 OPR—Owner's Project Requirements

3.2.13 OR-Operational Requirement

3.2.14 RA-Responsible Authority

3.2.15 SOO-Sequence of Operations

4. Significance and Use

4.1 There have been instances in the past in which undesired collisions between authorized vehicles and AVBS have occurred. Properly selected, designed, and installed safety devices that are able to inhibit deployment of active barriers when authorized vehicles are in the hazard detection space, in direct proximity to the barrier, can minimize the likelihood that such accidents occur.

4.2 Unintended barrier/vehicle collisions can be very hazardous, will frequently result in significant damage to property, and can also result in personal injury or death, depending on conditions surrounding an incident.

4.3 It is recognized that some vehicle types may not be reliably detected by an individual detection device and an owner may desire placing AVBS in service even though not all vehicle types may be reliably detected. In such determination of use, an owner shall carefully consider such system performance limitations and safety risks, appropriate alternative controls that will minimize safety hazards, and what risks are able to be accepted before placing equipment into service. This practice is intended to provide the owners, designers, installers, integrators, and equipment providers with information that

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