



APTA SS-SIS-RP-009-12, Rev. 2

First Published: December 1, 2012

First Revision: September 25, 2020

Second Revision: May 12, 2026

Infrastructure Security Working Group

Anti-Vehicle Barriers for Public Transit

Abstract: This recommended practice describes anti-vehicle barriers (AVBs) for transit passenger facilities to enhance the security of people, operations, assets and infrastructure.

Keywords: anti-vehicle barriers, barriers, bollards, design considerations, site survey, standoff distance

Summary: Public transit operates in inherently open environments. It provides ease of access and gathers volumes of people in confined spaces to provide passengers with efficient and convenient transportation. These unique attributes make public transportation vulnerable to adversarial targeting and threats. For these reasons, a sound understanding of anti-vehicle barriers will enable agencies to implement an approach to more effectively manage the risks of their environments. This document describes AVBs for transit passenger facilities, providing information on their specific uses, capabilities and placement considerations.



Foreword

The American Public Transportation Association is a standards development organization in North America. The process of developing standards is managed by the APTA Standards Program's Standards Development Oversight Council (SDOC). These activities are carried out through several standards policy and planning committees that have been established to address specific transportation modes, safety and security requirements, interoperability, and other topics.

APTA used a consensus-based process to develop this document and its continued maintenance, which is detailed in the [manual for the APTA Standards Program](#). This document was drafted in accordance with the approval criteria and editorial policy as described. Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

This document was prepared by the Infrastructure Security Working Group as directed by the Security and Emergency Management Standards Policy and Planning Committee.

This document represents a common viewpoint of those parties concerned with its provisions, namely transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any recommended practices or guidelines contained herein is voluntary. APTA standards are mandatory to the extent incorporated by an applicable statute or regulation. In some cases, federal and/or state regulations govern portions of a transit agency's operations. In cases where there is a conflict or contradiction between an applicable law or regulation and this document, consult with a legal adviser to determine which document takes precedence.

This document supersedes APTA SS-SIS-RP-009-12, Rev. 1, which has been revised. Below is a summary of changes from the previous document version:

- Expanded descriptions of AVB categories
- Removed references to K-ratings
- Introduced alternative passive barriers
- Added installation considerations
- Inserted new operational factors to additional considerations
- Incorporated new references
- Modernized standard contents by refining terminology and definitions, introducing new and emerging technology, and incorporating new research and guidance



Table of Contents

Foreword.....	ii
Participants.....	iv
Introduction.....	iv
Scope and purpose	iv
1. Anti-vehicle barrier overview	1
1.1 Categories	1
1.2 Stakeholder considerations	1
1.3 Benefits	2
2. Security risk assessment.....	2
3. AVB recommended practices	2
3.1 AVB uses and functions.....	2
3.2 AVB design.....	4
3.3 AVB selection.....	8
3.4 Location of anti-vehicle barriers.....	9
3.5 Anti-vehicle barrier access control	9
3.6 Barrier alternatives.....	9
3.7 Fencing systems	10
4. Installation considerations.....	10
5. Training considerations	10
6. Maintenance considerations.....	10
7. Cost-effectiveness	10
8. Liability.....	11
9. Additional considerations.....	11
Related APTA standards.....	12
References.....	12
Abbreviations and acronyms.....	13
Document history.....	13
Appendix A: AVB selection checklist	14

List of Figures and Tables

Table 1 AVB Crash Test Rating.....	3
Table 2 Vehicle Penetration Ratings	4
Table 3 Passive Barriers	5
Table 4 Active Barriers	7



Participants

The American Public Transportation Association greatly appreciates the contributions of the **Infrastructure Security Working Group**, which provided the primary effort in the drafting of this document.

At the time this standard was completed, the working group included the following members:

Branden Porter, *Sound Transit*, Chair
Shane Kelly, *Hampton Roads Transit*, Vice Chair

Aldon Bordenave, *LA Metro*
Neil Crosier, *King County Metro*
Fred Damron, *TSA*
Matthew Dimmick, *STV*
Dean Fajerski, *TSA*
Kevin Franklin, *Bay Area Rapid Transit*
Michael Gettings, *Greater Cleveland RTA Police*
Michelle Gorman, *New York City Police Dept.*
Michael Lee, *New York MTA*

Alan Love, *Bay Area Rapid Transit*
Chris McKay, *TSA*
Maurice McKinney, *WMATA*
Harry Saporta, *WSP USA*
Jill Shaw, *Dallas Area Rapid Transit*
Chablis Salters, *MARTA*
Lurae Stuart, *WSP USA*
Kirsten Tilleman, *WSP USA*

Project team

Polly Hanson, *American Public Transportation Association*
Eric Halzel, *Eagle Hill Consulting*

Introduction

This introduction is not part of APTA SS-SIS-RP-009-12, "Anti-Vehicle Barriers for Public Transit."

APTA recommends the use of this document by:

- individuals or organizations that operate public transit systems;
- individuals or organizations that contract with others for the operation of public transit systems; and
- individuals or organizations that influence how public transit systems are operated (including but not limited to consultants, designers and contractors).

Scope and purpose

This document provides background information on AVB systems, details the systems available, and describes the specific use and capabilities of AVB systems. It outlines the AVB selection process to present options for the best systems to use in specific environments. It also offers considerations to aid in the placement of the systems once the proper barrier is chosen.

Anti-Vehicle Barriers for Public Transit

1. Anti-vehicle barrier overview

Adversaries may use a vehicle, most commonly on its own (in the form of a vehicle ramming/vehicle as a weapon [VAW]) or laden with explosives (in the form of a vehicle-borne improvised explosive device [VBIED]), to carry out attacks against people, operations, assets and infrastructure in the transit environment. To reduce the risk from these threats, transit agencies should consider the design and placement of anti-vehicle barriers (AVBs). Anti-vehicle barriers may also be called *perimeter protection devices* and *vehicle security barriers*.

AVB systems differ in and are differentiated by their composition, capability and style. They are constructed of metals, concrete and other materials for durability to resist energy of vehicular penetration, and they may vary in style from being several feet in length to cylindrical in shape. For example, cylindrical, vertically installed AVB systems are referred to as bollards. Bollards vary in their construction and functional design, but they have many of the same capabilities as horizontally installed barriers—that is, to control vehicle access to an area.

After selection, but before placement, transit agencies should perform a site survey that includes an analysis of the site's existing features. The checklist in Appendix A provides a guide to complete and document a site survey.

1.1 Categories

For the purpose of this standard, AVBs are primarily classified into two categories: active (operable) or passive (static), both of which could be permanent or portable. Active barriers have moveable components, and their systems can be operated manually or mechanically to allow or restrict vehicle passage. Passive barriers do not require active operation and, unlike active barriers, are always in place. Both active and passive barriers are often used to protect a critical asset from vehicle intrusion and serve as a way to delineate or channel vehicle traffic. While AVBs may provide theft deterrence, asset protection, and pedestrian and traffic control, they are primarily used to control authorized vehicle access to an area.

Security professionals may also categorize AVBs as friction-based or design-barriers. Friction-based barriers rely on the friction between the mass of the placed barrier and the surface below to restrict lateral movement. Design-barriers, also called *kinetic barriers*, have an engineered footing to restrict movement.

Transit agencies can also often quickly deploy or improvise AVBs. Deployable AVBs are pre-designed, purpose-built systems that transit agencies can quickly activate. Improvised AVBs are ad hoc structures that use available materials to meet an immediate need.

1.2 Stakeholder considerations

The implementation of AVBs serves a meaningful purpose. To the extent possible, AVB application assists agencies in meeting their security program requirements while maintaining efficient operations. Well-designed and functional AVBs, such as planters, trash receptacles and bollards, can contribute to efficient

operations and be aesthetically pleasing to the communities that host agency properties and operations. When a permanent installation is not necessary, such as at the site of a special event not requiring permanent AVBs or when a threat emerges that requires immediate AVB implementation, temporary AVBs that may include purpose-designed and tested AVBs, or suitable temporary solutions, such as jersey barriers or parked dump trucks can be installed.

1.3 Benefits

A security system program that includes AVB applications offers the following benefits to an agency:

- Protects against harmful vehicle attacks or intrusions.
- Provides suitable standoff distance and clear zones.
- Fosters a sense of physical security.
- Creates a sense of ownership by transit users and employees.
- Allows for driver/vehicle vetting at access points.
- Manages access to authorized areas.
- Controls vehicle access to nonpublic areas.

2. Security risk assessment

Each transit agency should conduct and document a security risk assessment of its system and use the output as a guide to determining considerations for deploying AVBs. The assessment should be holistic and consider the total transit and local threat environment. The security risk assessment should evaluate the following:

- transit operating environment
- personnel (e.g., law enforcement, security, managers and frontline staff)
- facilities and infrastructure
- policy and procedures
- surrounding non-transit environment

Transit agencies should consider the facility’s design basis threat (DBT) when selecting barrier types. DBT approaches explore adversary motivations, intentions, and capabilities to provide confidence that deployed protective measures are effective and sustainable. Design basis threats may include conventional vehicles (e.g., passenger vehicles and trucks, electric vehicles), bicycles (including electric bikes) and motorcycles, and emerging technologies such as fully autonomous vehicles (FAVs).

For purposes of AVB selection, risk assessments should examine a system’s vulnerabilities related to vehicle ramming and VBIEDs. See CISA’s Vehicle Ramming Self-Assessment Tool and APTA SS-SIS-S-017-21, “Security Risk Assessment Methodology for Public Transit,” for additional information about methodologies to determine security risk in public transportation systems.

3. AVB recommended practices

3.1 AVB uses and functions

3.1.1 Uses

While AVBs can be used in many ways, their primary function is to control authorized vehicle access. They can be installed at a facility’s gates or entrances (vehicle “checkpoints”), around security guard booths, between designated parking areas and buildings, adjacent to high-value facilities or assets, or as a protective barrier around temporary events or activities. To minimize threats, transit agencies should test, rate, properly install and use AVBs in conjunction with other physical security measures (guards, surveillance, etc.).

3.1.2 Functions

Passive AVB systems such as planters, fixed bollards and modular concrete barriers (otherwise known as *K rails* or *Jersey barriers*) are intended to remain in a fixed position to prevent vehicle access. Active systems such as pop-up wedges, retractable bollards and drop-arm barriers manage the access of vehicles.

AVB systems may be tested, engineered or non-rated, as defined below:

- **Tested:** The manufacturer or an independent third party has tested the AVB system against ASTM F2656/F2656M, “Standard Test Method for Crash Testing of Vehicle Security Barriers,” and given it an M rating. The M in this standard references a medium-duty truck (15,000 lb).
- **Engineered:** The manufacturer claims that the barrier has been engineered to meet a specific crash test requirement. For example, “This barrier has been engineered to meet the ASTM PU40 standard for fixed bollards.” This indicates that the barrier has not undergone testing to this level in accordance with ASTM standards.

NOTE: PU40 is indicative of a 5070 lb vehicle (pickup) traveling at 40 mi/h.

- **Non-rated:** The AVB has not been tested, nor has it been engineered to meet an ASTM or equivalent rating scheme.

3.1.3 Anti-vehicle barrier ratings

ASTM F2656 rates the effectiveness of AVB systems. This standard provides both the crash rating and a subsequent penetration rating. The crash rating indicates the barrier’s ability to stop the 15,000 lb vehicle at the designated speed (30, 40 or 50 mi/h). The penetration rating indicates how far the vehicle encroaches on the protected space after striking the barrier.

Table 1 and **Table 2** summarize ASTM’s F2656 ratings and provide the Department of Defense (DoD) K-ratings, though K-ratings are effectively retired.

TABLE 1
 AVB Crash Test Rating

M-Rating	Gross Vehicle Weight (lb)	Vehicle Speed (mi/h)	K-Rating
M50	15,000	50	K12
M40	15,000	40	K8
M30	15,000	30	K4

TABLE 2
 Vehicle Penetration Ratings

ASTM or DoS Rating	Penetration Rating	Penetration Distance
ASTM	P1	Less than 3.3 ft
ASTM	P2	3.3–23 ft
ASTM	P3	23–98.4 ft (Note: Anything greater than 98.4 ft is considered a failure)
DoS	L3	Less than 3 ft (Note: As of 2003, only L3 was acceptable in terms of penetration distance for AVBs)
DoS	L2	3–20 ft
DoS	L1	20–50 ft

3.2 AVB design

AVBs are either passive (static or non-moveable), meaning they have no moveable parts; or active (operator controlled for access), meaning some parts of the barrier are moveable. They are manufactured and rated to resist different levels of kinetic energy and are also available in different design styles, such as flush or surface-mounted wedge, plate or bollards; rolling (sliding) gate; and drop-arm designs. However, some barriers, such as planters and walls, may not have been tested. Once an agency has selected the performance design, it should see APTA SS-SIS-RP-007-10, “Crime Prevention Through Environmental Design at Public Transit Facilities,” for additional information.

Typical active AVB designs should include the appropriate support equipment, such as backup power; an emergency cutoff switch; adequate lighting and safety options (e.g., alarms, strobe or rotating beacon lights, and safety interlocks to prevent the AVB from being accidentally activated); vehicle sensing loops (on the secure side to prevent activation of the barrier until the vehicle has completely cleared the AVB); safety markings; and signage. All AVB supporting equipment should be located on the secure side of the barrier and should be monitored on a continual basis by video surveillance and an intrusion detection system (IDS) to reduce its potential for being sabotaged, as well as for optimum functionality. Additionally, the area surrounding an AVB should be monitored for security, and transit agencies should address AVB technical requirements, such as clearance distances and minimum heights.



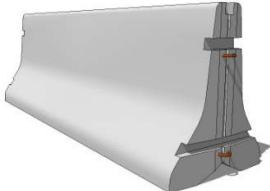

Passive vehicle barriers are non-moveable systems. Passive barriers include steel or concrete framed or reinforced earthen barriers; plastic (water-filled) or steel-reinforced concrete modular concrete barriers (“Jersey barriers”); planter-style security barriers; steel “impaler-style” barriers; concrete or metal bollards; and permanently installed concrete, cinder/concrete block or brick wall-type barriers. In contrast, active vehicle barriers are characterized by their ability to move and can be operated manually or automatically.

The bollard is one of the most versatile components in comprehensive integrated design planning and design execution. Because of their breadth of design styles, bollards are an easy candidate to complement a broad spectrum of building architectural and landscaping designs. Bollards can be made from any of the following materials: cast iron, stainless steel, steel/cast iron composite, recycled plastic or plastic covers. Bollards can be active or passive as well.

Detailed descriptions of passive and active barriers are given in [Table 3](#) and [Table 4](#).




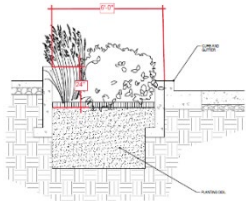
APTA SS-SIS-RP-009-12, Rev. 2
Anti-Vehicle Barriers for Public Transit

TABLE 3
 Passive Barriers

Barrier System	Description	Utilization	Typical Height and Length	Construction (Material)
<p>Steel/concrete framed/reinforced earthen</p> 	<p>Typical steel concrete framework backfilled with soil and topped with sod</p>	<p>Striped, flashing lights, sirens, etc. Used in open areas with plenty of space and when cost is an issue. Can be used to route or direct vehicle traffic circulation.</p>	<p>Height and weight vary depending on application and vulnerability of the structure.</p>	<p>Steel or concrete</p>
<p>Plastic (water-filled) barrier</p> 	<p>Available in various styles, lengths, shapes and colors</p>	<p>Placed as protective barriers where needed; can be arranged end to end, side by side, or even stacked for increased security.</p>	<p>Height: 32–42 in.</p>	<p>Typically, molded plastic filled with water</p>
<p>Concrete modular barriers (K-rails or Jersey barriers)</p> 	<p>Available in various styles, lengths, shapes and colors</p>	<p>Used in or along driveways or roads to direct traffic to a checkpoint.</p>	<p>Height: 32–36 in. Length: 9–10 ft</p>	<p>Steel-reinforced concrete</p>
<p>Planter-style security barriers</p> 	<p>Concrete “shell” backfilled with soil for added protective weight</p>	<p>Prevents vehicle intrusion; protects walkways, fences, guard booths and important equipment and prevents driving around other barriers; can be used to route or direct vehicle or pedestrian traffic.</p>	<p>Height and weight vary depending on application and vulnerability of the structure.</p>	<p>Steel reinforced concrete “shell”</p>

APTA SS-SIS-RP-009-12, Rev. 2
Anti-Vehicle Barriers for Public Transit

TABLE 3
 Passive Barriers

Barrier System	Description	Utilization	Typical Height and Length	Construction (Material)
<p>Concrete or metal bollards</p> 	<p>Vertically installed metal (preferably steel) “crash tube” with the lower base extending into the ground; in use in numerous military and commercial applications</p>	<p>Inhibits vehicle intrusion, protects walkways, fences, guard booths, important equipment and prevents driving around other barriers; can be used to route or direct vehicle or pedestrian traffic; bollards spaced affording ADA compliance minimizes pedestrian inconvenience and complies with ADA requirements).</p>	<p>Height: 18–60+ in. Diameter: Varies depending on application; typically 8–24 in.</p>	<p>Solid steel or hollow tube filled with reinforced concrete</p>
<p>Permanently installed concrete, cinder/concrete block, or brick wall-type barriers</p> 	<p>A vertically constructed and installed reinforced concrete, cinder/ concrete block, or brick wall</p>	<p>Installed around a security zone or high-value asset requiring protection.</p>	<p>Height and weight vary depending on application and vulnerability of the structure.</p>	<p>Concrete, cinder/ concrete block, or brick</p>
<p>Traffic controllers (“tire teeth”)</p> 	<p>Metal teeth used to cut/shred vehicle tire; either spring mounted to allow safe one-way travel or retractable to allow two-way travel</p>	<p>Prevention of wrong-way traffic flow (parking applications) and deployable to flatten tires if vehicles cross security access point.</p>	<p>Approximately 1 in. wide by 4 in. long teeth are used.</p>	
<p>In-ground rain garden design</p> 	<p>6 ft wide rain garden designed to be recessed in the ground with a curb gutter on the outside and a 24 in. concrete wall on the inside</p>	<p>Protects pedestrian-gathering areas from vehicle intrusion.</p>	<p>Height, width, and length vary depending on application.</p>	<p>Concrete, rocks and dirt</p>

APTA SS-SIS-RP-009-12, Rev. 2
Anti-Vehicle Barriers for Public Transit

TABLE 3
 Passive Barriers


Barrier System	Description	Utilization	Typical Height and Length	Construction (Material)
Alternative barriers 	Various forms of deployable, mobile anti-vehicle solutions, which may include municipal dump trucks filled with sand, garbage trucks, cement blocks and deployable steel barriers.	Mobile barriers are deployed to an area, usually by security and/or law enforcement personnel to temporarily restrict vehicle access to the protected area. The barrier selected should be appropriate for the risk being mitigated.	Dependent on resource availability, threat and duration of the need.	Dependent on resource availability, threat and duration of the need.

TABLE 4
 Active Barriers




Barrier System	Description	Utilization	Typical Height and Length	Construction (Material)
Hydraulically deployable metal bollards 	Subsurface vertically installed metal “crash tube.” Once deployed, part of tube is above surface with the lower part extending into the ground; in use in numerous military and commercial applications.	Inhibits vehicle intrusion; protects walkways, fences, guard booths and important equipment; prevents driving around other barriers; can be used to route or direct vehicle or pedestrian traffic.	Height: 18–36+ in. Diameter: Varies depending on application; typically 12–24 in.	Constructed of solid tubular steel, can be filled for added strength.

TABLE 4
Active Barriers

Barrier System	Description	Utilization	Typical Height and Length	Construction (Material)
Permanently installed “recessed-mounted” (in-ground) ramp-style vehicle barriers with chain reinforcements. 	These ramp systems weigh between 2500 and 12,000 lb and are installed subgrade and flush-mounted in the surface of the road. The ramp barrier system is raised or lowered either manually or automatically (based on access being granted) through use of computer-controlled electrical or hydraulic systems.	As a barrier for the perimeter boundary to stop and/or disable unauthorized vehicle penetration	Width: 1–24 ft Height: About 3 ft	Steel
Wedge-style vehicle barriers (with chain reinforcements) 	27° lift angle facing the opponent’s direction of approach. Temporary or permanently installed; mounted at grade. These ramp systems weigh between 2500 to 12,000 lb. The ramp barrier system is raised or lowered either manually or automatically (based on access being granted) through use of computer-controlled electrical or hydraulic systems.	As a barrier for the perimeter boundary to stop and/or to disable unauthorized vehicle penetration	Width: 1–24 ft Height: 3 ft	Steel

AVBs should be designed and deployed to restrict entry of unauthorized vehicles into specific facility areas, especially during heightened National Terror Advisory System (NTAS) conditions. AVBs may be significantly damaged after absorbing the full impact of a moving vehicle. The barrier may not be fully functional or operational after impact and may fail if kept in service. To determine AVB serviceability, any AVB sustaining an impact should be inspected. It may require repair, restoration or replacement to remain in service and to maintain its agency certification.

3.3 AVB selection

When selecting a barrier, it is important to begin with a site survey. The site survey should include the relative locations, major dimensions and descriptions of buildings and structures, roads, terrain and landscaping; existing security features; and the property perimeter. Agencies can determine the proper levels of protection based on analysis of these factors. Other factors to consider as part of the terrain include:

- whether the structure that is going to be protected is downhill;
- whether the road leading to it is straight or curved; and
- whether the building is accessible to an unauthorized vehicle through other means.

It may be necessary to install more than one set of barriers to counter the effects of the momentum of an unauthorized vehicle attempting to breach the perimeter.

There are also other important factors to consider when choosing a barrier system. They include the requirement for barrier system type, installation plans, the required number and placement, aesthetic requirements, local codes, and emergency response procedures. The chosen barrier system should also be compatible with the other security components in place. For example, an active barrier system should not be installed adjacent to an unhardened chain-link fence, because then the fence would become the weakest path.

In addition to a site survey, agencies must consider other factors during the selection process of an AVB, including:

- Maintaining safe and efficient ingress and egress.
- Ensuring access for emergency responders during an unplanned event.
- Ensuring that hostile or unaware actors cannot exploit emergency access points.
- Avoiding “choke points” for crowds leaving an area or venue.
- Maintaining accessibility and visibility for pedestrians with mobility limitations.
- Reviewing permitting requirements.

Appendix A provides a checklist that incorporates the selection process and the vehicle barrier design and installation requirements.

3.4 Location of anti-vehicle barriers

The location of AVBs can vary based on their design as active or passive and the area they are protecting. Active vehicle barriers are most often placed at facility entrances. They can also be placed at select interior locations. The exact location of active barriers may vary among installations; in each case they should be placed as far from the critical structure as practical to minimize damage due to possible intrusion explosion. Passive barriers should be located at entry points to manage traffic if traffic flow is restricted or periodic. Passive barriers are most often used for protection of perimeter boundaries. The agency’s risk assessment will determine its adequate standoff distance for the proper placement of barriers.

3.5 Anti-vehicle barrier access control

Active barriers provide the primary means of access control. Access control can be accomplished with a staffed guard or remotely through the use of card or biometric access control devices that will automatically activate the barrier. They can also operate the barrier remotely from a protected location outside the entry control point. When selecting access control methods, transit agencies must ensure the safe and reliable operation of all barriers.

3.6 Barrier alternatives

There are several alternatives to AVB systems, including the following:

- ditches
- heavy equipment tires
- tire shredders
- non-reinforced concrete blocks
- heavy vehicles or equipment (e.g., dump trucks filled with sand)
- buses (although empty school buses do not perform well in penetration testing)

3.7 Fencing systems

Fences should not be considered as protection against moving vehicle attacks unless engineered for an AVB purpose. Most fences can be easily penetrated by a moving vehicle and will resist impact only if reinforcement is added. Fences are used primarily to provide a boundary by defining the outermost limit of a facility and to assist in controlling and screening authorized vehicle entries into a secured area by deterring overt entry elsewhere along the boundary. Fences also support detection, assessment and other security functions by providing a “clear zone” for installing lighting, intrusion detection equipment and video surveillance. For additional information on fencing, APTA SS-SIS-RP-003-10, “Fencing Systems to Control Access to Transit Facilities.”

4. Installation considerations

Transit agencies should consult with qualified personnel to address potential installation considerations, including but not limited to vehicle trajectory analysis, vehicle dynamics analysis, civil/structure concerns related to barrier weight and footings, etc. The higher the speed of an approaching vehicle, the greater the potential impact. Even a minor reduction in speed can lead to significant decreases in the vehicle's energy, creating a less severe impact. Transit agencies should explore approaches to reduce or remove head-on impact approaches.

5. Training considerations

Most manufacturers recommend operator training for active barrier systems. Operator training prevents serious injury and legal liability, as well as equipment damage caused by improper operations. If a manufacturer does not provide a thorough program for operator training, the agency should develop the appropriate checklist for normal and emergency operating procedures.

6. Maintenance considerations

Many manufacturers provide wiring and hydraulic diagrams, maintenance schedules, and procedures for their systems. Selected manufacturers should also have spare parts available to keep barriers in continuous operation. The manufacturer should provide barrier maintenance support in the form of training and operation and maintenance manuals. Maintenance contracts and reliability and maintainability data are available from most manufacturers. Maintenance should include timely inspection, adjustment, cleaning, pressure checks on operational systems and replacement of worn parts.

Transit agencies should check with the manufacturer for a list of current customers deploying its products, and then consider speaking with those agencies to ascertain performance and other service data about the product being considered.

After any strike, transit agencies should conduct inspections and maintenance to ensure full functionality and crashworthiness, even if the barrier appears undamaged.

7. Cost-effectiveness

Trade-offs on protective measures may include the following:

- locating the vehicle barrier to provide optimum separation distance
- slowing down vehicles approaching the barrier, using obstructions or redesign of the access route
- barrier open to permit access vs. closed to prevent access
- active vs. passive barriers
- system-activating options: manual vs. automatic, local vs. remote, electrical vs. hydraulic
- safety, reliability, availability and maintainability characteristics

8. Liability

Possible legal issues may arise from accidents that cause deaths or injuries. The agency should consult with legal representation when considering the installation of an active vehicle barrier system to ensure that it is complying with all local, state and federal laws and regulations.

9. Additional considerations

Agencies should also consider the following when selecting and installing barrier systems:

- If the location of a vehicle barrier is in an area of high water table or there is subsurface critical infrastructure, consider using a surface-mounted or shallow profile barrier system. Below-ground barriers are acceptable if the required installation depth is above the water table. If the excavation cannot be drained, then water collection could cause corrosion, and freezing weather may incapacitate the system.
- Designers should consider guidelines and standards relating to access for people with disabilities.
- When barriers are installed at entrance and exit gates, also consider installing passive barrier systems along the remaining accessible perimeter of the protected area.
- Protection of individual buildings or zones within the perimeter is generally more cost-effective than extensive protection of a large facility perimeter. For example, passive barriers installed in areas where vehicles cannot reach, just to complete a perimeter barrier system, are not an effective use of security funding.
- Transit agencies should consider the potential of fires due to friction and sparks at vehicle strike sites and plan appropriate separation of colocated structures (e.g., guard booths) and placement of fire suppression equipment.
- Transit agencies should address operational considerations, including contingency plans for system failures and natural hazards.
- Since most types of active barriers can be easily sabotaged, consider installing active barriers only in areas where they can be under continuous observation.
- Barriers should be used to divert traffic or prevent entry or exit. Installation of barriers immediately adjacent to guard posts is not desirable because the possibility of injury should be minimized. Consider keeping vehicle barriers as far from guard posts as possible.
- Consider installing barriers on the exit side of an access control point as well as the entrance.
- Long, straight paths to a crash-resistant barrier can result in increased vehicle speed and greater kinetic energy upon impact. Where this cannot be avoided, installation of a passive-type barrier maze should be considered to slow vehicles. Transit agencies can also deploy appropriately designed speed tables in areas where chicanes or barrier mazes aren't feasible.
- Consider emergency evacuation and first responder emergency access when designing and installing AVBs.
- Designers should consider permitting requirements by local jurisdictions.

Related APTA standards

APTA SS-SIS-RP-003-10, “Fencing Systems to Control Access to Transit Facilities”

APTA SS-SIS-RP-007-10, “Crime Prevention Through Environmental Design at Public Transit Facilities”

APTA SS-SIS-S-017-21, “Security Risk Assessment Methodology for Public Transit”

References

American Society for Industrial Security (ASIS), “International Glossary of Security Terms.”

ASTM International, “Standard Test Method for Crash Testing of Vehicle Security Barriers.”

Centre for the Protection of National Infrastructure (CPNI), “Public Realm Design Guide Hostile Vehicle Mitigation,” 2022.

Department of Homeland Security, Cybersecurity and Infrastructure Security Agency (CISA), “Vehicle Incident Prevention and Mitigation Security Guide,” 2024. <https://www.cisa.gov/resources-tools/resources/vehicle-incident-prevention-and-mitigation-security-guide>

Department of Homeland Security, Cybersecurity and Infrastructure Security Agency (CISA), “Vehicle Ramming Self-Assessment Tool,” 2024. <https://www.cisa.gov/vehicle-ramming-self-assessment-tool>

Department of Defense, U.S. Army Corps of Engineers, Protective Design Center, “DoD Anti-Ram Vehicle Barrier List,” June 2025. https://www.nwo.usace.army.mil/Portals/23/docs/PDC/DOD_Anti-ram_Vehicle_Barriers_Sept_2025.pdf?ver=5bZfzlp6VYIeOj--53IYA%3D%3D

FTA Office of Research Demonstration and Innovation, “Transit Security Design Considerations,” Appendix E, Vehicle Barrier Selection and Implementation Considerations. transit.dot.gov/sites/fta.dot.gov/files/docs/ftasesc.pdf

National Academies of Sciences, Engineering, and Medicine, “Intrusion Detection for Public Transportation Facilities Handbook,” 2003. <https://www.nap.edu/catalog/24728/intrusion-detection-for-public-transportation-facilities-handbook>

New York City Police Department, “Engineering Security: Protective Design for High Risk Buildings,” 2009. https://www.nyc.gov/assets/nypd/downloads/pdf/nypd_engineeringsecurity.pdf

National Academies of Sciences, Engineering, and Medicine, “Security 101: A Physical and Cybersecurity Primer for Transportation Agencies,” 2019. <https://www.nap.edu/catalog/25554/security-101-a-physical-and-cybersecurity-primer-for-transportation-agencies>

Oakes, Charles, “Bollard: Non-Crash and Non-Attack-Resistant Models,” 2010. <https://www.wbdg.org/resources/bollard-non-crash-and-non-attack-resistant-models>

Unified Facilities Criteria, “Selection and Application of Vehicle Barriers,” UFC 4-022-02, August 2010. https://www.wbdg.org/FFC/DOD/UFC/ufc_4_022_02_2009_c1.pdf

Abbreviations and acronyms

AVB	anti-vehicle barrier
ASTM	American Society for Testing and Materials
CISA	Cybersecurity and Infrastructure Security Agency
CPTED	crime prevention through environmental design
DBT	design basis threat
DoD	Department of Defense
DoS	Department of State
FAV	fully autonomous vehicles
FEMA	Federal Emergency Management Agency
IDS	intrusion detection system
K-rating	kinetic energy rating for AVBs
NTAS	National Terror Advisory System
PT-RAM	Public Transit–Risk Assessment Methodology
TVA	threat and vulnerability assessment
VAW	vehicle as a weapon
VBIED	vehicle-borne improvised explosive device

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	CEO Approval	Policy & Planning Approval	Publish Date
First published	—	—	—	—	Dec. 1, 2012
First revision	May 7, 2020	June 6, 2020	June 22, 2020	Aug. 20, 2020	Sept. 25, 2020
Second revision	Oct. 17, 2025	Dec. 3, 2025	Feb. 28, 2026	April 10, 2026	May 12, 2026

Appendix A: AVB selection checklist

The following list incorporates the selection process for anti-vehicle barrier design and installation requirements. Agencies in the process of selecting an AVB should consider review of the information contained in it, answering each question based on the results of its TVA:

1. Describe the design basis threat as determined by the agency's risk assessment.
2. What is the type, weight, maximum velocity, contents and calculated kinetic energy of the threat vehicle? What type of attack? Single vehicle or multiple vehicles?
3. Is there sufficient standoff distance between the planned barrier and the protected structure?
4. What is the expected speed of the vehicle?
5. Can the speed of the vehicle be reduced (via speed bumps, serpentine approach, etc.)?
6. What is the calculated kinetic energy developed by the moving vehicle?
7. Have all impact points along the perimeter been identified?
8. Have the number of access points requiring vehicle barrier installation been minimized?
9. What is the most cost-effective active barrier available that will absorb the kinetic energy developed by the threat vehicle?
10. Does site design account for potential fires at the strike site?
11. How many barriers are required at each entry point to meet throughput requirements?
12. What is the most cost-effective passive barrier that will absorb the kinetic energy developed by the threat vehicle?
13. Will the use of aesthetic barriers at some locations be necessary?
14. Is penetration into the site a factor?
15. If penetration into the site is a factor, is the standoff distance adequate after impact?
16. Will traffic flow be affected by the barrier's normal cycle rate? What is the active barrier's maximum throughput rate per day/hour? What is the number of available traffic lanes: one-way only, reversible, width and separation? Is the roadway flat/sloping/crowned, islands, etc.?
17. Will the active barrier need to be activated at a rate higher than the normal rate?
18. Will the barrier be required to be normally open (to allow traffic to pass) or normally closed (to stop traffic flow)?
19. If normally open (allowing traffic flow), is adequate distance available between the guard post and the barrier to allow activation and operation of the barrier?
20. Will the barrier be subject to severe environmental conditions? Consider high/low temperatures, rainfall, drainage, snow and frost. Survey the site for subsurface conditions: berms, landscaping, buried utilities, drainage, frost line and water table height. Also consider zoning laws.
21. Do passive barriers installed along the perimeter provide equivalent protection to the active barriers?
22. Do passive barriers interfere with established clear zone requirements?
23. In case of power failure, will the barrier fail open or closed? Is there an emergency backup power source? Are there warning/safety signs/signals/strobes/horns to warn of the barriers ahead? Are there semaphore gate arms? Are they in sync with the barrier deployment?
24. Is this a temporary or permanent installation?
25. Has the agency considered CPTED principles? See the APTA SS-SIS-RP-007-10, "Crime Prevention Through Environmental Design at Public Transit Facilities."