



VEHICLE INCIDENT PREVENTION AND MITIGATION

Security Guide

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INTRODUCTION

Vehicles can present a variety of potential security threats to critical infrastructure and the professionals supporting it. Terrorists, violent extremists, or other criminals can use a vehicle as a ramming device or possibly a platform for an improvised explosive device (IED). As state, local, and tribal partners are already aware, vehicle ramming can also be accidental, vehicular harm caused by a driver who lacks malicious intent when colliding with people or infrastructure.

Vehicular attacks are versatile, easy to execute, and often difficult to predict. In these and other less malicious scenarios, vehicles pose a direct threat to people and infrastructure. In short, vehicle incidents can happen almost anywhere and at any time.

OVERVIEW OF CONTENTS

The Vehicle Incident Prevention and Mitigation Security Guide aims to provide vehicle threat mitigation training and recommended options for consideration. It offers an overview of the threat environment and provides resources to help stakeholders strengthen organizational security and safeguard against direct threats and unintentional hazards. This resource is intended for facilities and venues of all sizes.

HOW TO USE THIS GUIDE

While this guide provides a foundation for incident prevention, not every recommendation will apply to every organization. The Department of Homeland Security (DHS) Cybersecurity and Infrastructure Security Agency (CISA) encourages users to choose the tools, practices, and procedures that best apply to their unique facilities. Organizations should also consult with security professionals to ensure their approach is consistent with industry-accepted practices and principles.

The guide's Conclusion section includes a [Where to Begin](#) checklist that outlines initial steps for implementing a robust vehicle incident prevention and mitigation program. Please note that this guide is designed to help start the conversation around vehicle incident prevention and mitigation. Keep in mind that every site, facility, and mass gathering event is different, and there is no one-size-fits-all security solution.

DISCLAIMER: Use of the guidance in this resource will not deter or prevent all attacks, and CISA and DHS have no liability for the failure of these recommendations to prevent an attack.



1 THE VEHICLE THREAT ENVIRONMENT

KEY POINTS

- Public U.S. government bulletins continue to reference the opportunity for threat actors to impact mass gatherings. The [June 2022 National Terrorism Advisory \(NTAS\)](#), as an example, highlighted an Islamic State call for attacks, including those conducted by vehicle ramming.¹
- Vehicle attacks most commonly take the form of vehicle ramming incidents, although the potential threat of vehicle-borne improvised explosive devices (VBIED) persists.
- Accidental vehicle incidents can also pose a significant threat to people and property.
- Emerging technologies in the form of fully autonomous vehicles (FAV) may pose a threat as they expand the potential tactics malicious actors can employ for targeted vehicle attacks.



VEHICLE INCIDENT TACTICS OVERVIEW

Although attacks involving vehicle ramming, VBIED detonation, a combination of these tactics, and possibly other violent tactics are less frequent than other high-profile tactics like active shootings, they continue to represent a significant threat in the United States.

In recent decades, malicious actors have shifted from training small, loyalist cores of threat actors for single spectacular attacks to recruiting unknown lone individuals. These persons, who may even be self-radicalized, may then carry out stand-alone, lower-impact attacks.²

The DHS 2018 Soft Targets and Crowded Places Security Plan Overview emphasized that mass gathering events lacking effective security measures are attractive targets.³ Malicious actors, including Foreign Terrorist Organizations, domestic criminals, and lone actors, can easily target crowded places with the intent to harm people and damage infrastructure.⁴ Deliberate efforts to prevent, protect against, and mitigate active assailant threats, including vehicle attacks, significantly reduce risk in this complex threat environment.

1. DHS. "Summary of Terrorism Threat to the United States." National Terrorism Advisory System. June 7, 2022. [dhs.gov/ntas/advisory/national-terrorism-advisory-system-bulletin-june-7-2022](https://www.dhs.gov/ntas/advisory/national-terrorism-advisory-system-bulletin-june-7-2022).
2. Jenkins, Brian Michael and Butterworth, Bruce R. "An Analysis of Vehicle Ramming as a Terrorist Tactic." Mineta Transportation Institute. May 2018. <https://transweb.sjsu.edu/research/Analysis-Vehicle-Ramming-Terrorist-Threat>.
3. DHS. "Soft Targets and Crowded Places Security Plan Overview." CISA.gov. May 2018. [cisa.gov/sites/default/files/publications/DHS-Soft-Target-Crowded-Place-Security-Plan-Overview-052018-508_0.pdf](https://www.cisa.gov/sites/default/files/publications/DHS-Soft-Target-Crowded-Place-Security-Plan-Overview-052018-508_0.pdf).
4. DHS. 2018 Soft Targets and Crowded Places Security Plan Overview, May 2018.

Data Methodology

CISA analyzed intentional and unintentional vehicle incidents from 2000 to 2022 using data provided by Brian Michael Jenkins, Bruce R. Butterworth, and Sachi Yagyu at the Mineta Transportation Institute. This data set, which included vehicle attacks committed through rammings, VBIEDs, and complex coordinated efforts, covered publicly available incidents in the United States, Europe (representing the European Union, United Kingdom, and Norway), and a small subset of other countries, including Canada, Australia, New Zealand, Japan, and Taiwan. The analysis covered a total of 347 incidents (n = 347) with 164 (47%) VBIEDs and 185 (53%) vehicle rammings. Select similar countries to the United States and those other than the United States and Europe are referred to as “Other Countries” and yield a subset of 18 attacks, which represents only 5% of the total.⁵

How European Incidents Are Relevant to the United States

The study included select foreign incidents that might serve as indicators or reference points when evaluating security trends in the United States. Hostile actors sometimes adopt tactics from incidents in other locations, and research has shown that terrorism-related methods and actions in one region can influence those in another. Some experts have referred to vehicle ramming trends as an “imitative wave” of incidents, not only in terms of frequency, but also in the diversity of the perpetrators.⁶ To illustrate this point, the graph below (Figure 1) depicts intentional vehicle ramming incidents in both Europe and the United States on the same timeline:

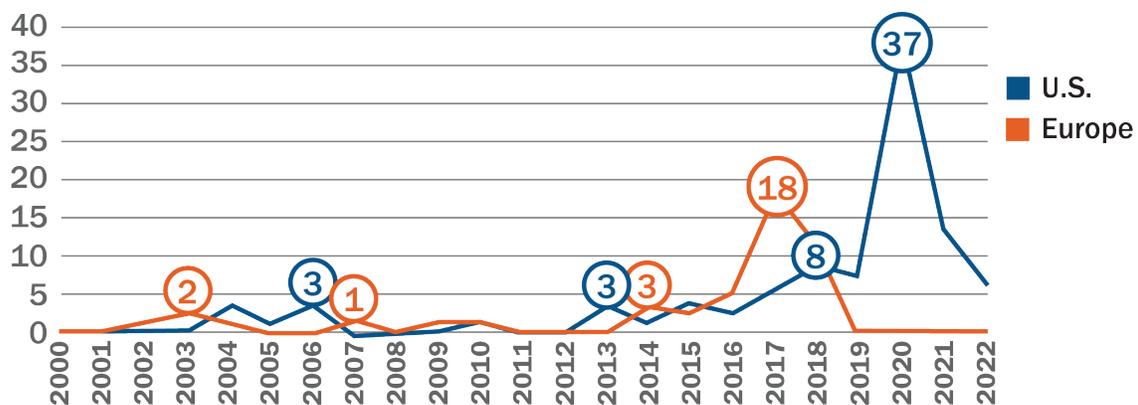


Figure 1. United States and Europe intentional rammings.

This graph reflects intentional vehicle rammings that occurred in the U.S. and Europe between 2000–2022. This includes incidents that occurred during the 2020 U.S. protest environment, where exact numbers and motivations are somewhat indeterminate (see [Case Study: Protest-Related Vehicle Rammings, Summer 2020](#) for more on this topic), but the data shows possible evidence of some imitative trends in vehicle ramming tactics. Notably, while significantly fewer vehicle rammings (n = 55) occurred in Europe than in the United States (n = 111) during the studied period, European incidents resulted in a higher average casualty count (173+ fatalities and 900+ injuries).⁷

5. In the case of VBIEDs, the analysis was expanded to include attacks against officials and installations of civil and military government and political leaders. By contrast, vehicle rammings aimed at these targets were not included. Vehicle rammings targeting facilities with their own security, such as embassies and military installations, were excluded, as were rammings of police vehicles and military patrols. Excluded from both VBIED and vehicle ramming attacks were attacks by groups or individuals against specific persons (i.e., car bombs intended to assassinate vehicle occupants, including officials and political leaders, when they were in a vehicle rigged with a bomb). Also excluded were attacks involving personal disputes (i.e., rammings in road rage incidents).
6. Miller, Vincent and Keith J. Hayward, “I Did My Bit’: Terrorism, Tarde and the Vehicle Ramming Attack as an Imitative Event.” *The British Journal of Criminology*, Vol. 59, Issue 1, January 2019, pp. 1-23. Published July 12, 2018. <https://doi.org/10.1093/bjc/azy017>.
7. Brian Michael and Bruce R. Butterworth’s 2019 analysis “Smashing Into Crowds—An Analysis of Vehicle Ramming Attacks” was one of the first to identify a possible trend of imitative vehicle attacks. <https://transweb.sjsu.edu/research/SP1119-Vehicle-Ramming-Update>.



Vehicle Ramming

A vehicle ramming incident is a kinetic attack in which a perpetrator intentionally uses a motor vehicle as a weapon, aiming it at a target with the intent to cause fatal injuries or significant property damage through forceful impact. Typical perpetrators in such incidents include drivers experiencing road rage, people motivated by domestic violence situations, criminals attempting to evade capture, extremists with religious or political motives, or individuals with cognitive impairments that lead to hostile behavior.⁸

“If it had not been for the concrete pillar [that blocked vehicle access to the main doors of the departure hall] that vehicle could have been inside the airport, and you could never imagine the casualties that would have happened there. [...] Thankfully only for the sake of that and the intervention of members of the public, who actually challenged these people, we will never know what could have happened.”

— Former detective David Swindle, who oversaw the Glasgow police operation when perpetrators driving a sport utility vehicle (SUV) filled with incendiary devices attempted to ram holiday-goers and enter the main terminal at Glasgow Airport. The attack failed.⁹

Crowded locations including sidewalks adjacent to critical infrastructure, as well as sports venues, open-air markets, and other public gathering locations may be attractive to a hostile actor using a vehicle as a weapon. Vehicles are readily accessible, relatively affordable, and effective as weapons, making them a seemingly convenient choice for malicious actors. Additionally, vehicles are widespread in the American landscape, with approximately 276 million registered vehicles on the road as of June 2022, according to the U.S. Federal Highway Administration.¹⁰

A 2022 DHS report on the rise of domestic extremism in the United States noted “an elevated threat” due to sociopolitical developments.¹¹ Furthermore, a November 2022 NTAS bulletin indicated that “small groups motivated by a range of ideological beliefs and/or personal grievances,” continue to pose a persistent threat. Although that particular bulletin expired, with the NTAS program now replaced by the annual Homeland Security Threat Assessment, various other intelligence bulletins have periodically noted a heightened threat of disruption or attacks by foreign terrorists and other malicious actors toward public gatherings.¹²

While jihadist threats represent a relatively small subset of recent U.S. news headlines, some organizations persist in promoting and planning mass-casualty attacks on Western targets. In a 2010 article from Al-Qaeda in the Arabian Peninsula’s (AQAP) Inspire Magazine, titled “The Ultimate Mowing Machine,” Al-Qaeda encouraged adherents to “mow down the enemies... with vehicles... to strike as many people as possible in your first run.” The article preceded numerous lone actor ramming incidents in Europe, as well as several in the United States. In its March 2021 Global Trends Report, the U.S. Office of the Director of National Intelligence noted, “Global jihadist groups are likely to be the largest, most persistent transnational threat as well as a threat in their home regions” for reasons such as their “coherent ideology.”¹³

8. CISA. “Patron Protection Resources.” cisa.gov/resources-tools/resources/patron-protection-resources.

9. Brocklehurst, Steven. “The day terror came to Glasgow Airport.” BBC Scotland, June 30, 2017. <https://www.bbc.com/news/uk-scotland-40416026>.

10. Federal Highway Administration, Policy and Government Affairs, Office of Highway Policy Information. “Table MV-1 - State Motor-Vehicle Registrations – 2020, Highway Statistics 2020.” Last updated June 15, 2022. [fhwa.dot.gov/policyinformation/statistics/2020/mv1.cfm](https://www.fhwa.dot.gov/policyinformation/statistics/2020/mv1.cfm).

11. DHS. “Report to the Secretary of Homeland Security Domestic Violent Extremism Internal Review, Observations, Findings, and Recommendations.” March 11, 2022. [dhs.gov/publication/dhs-report-domestic-violent-extremism-internal-review](https://www.dhs.gov/publication/dhs-report-domestic-violent-extremism-internal-review).

12. DHS. “Summary of Terrorism Threat to the United States.” National Terrorism Advisory System. November 30, 2022. [dhs.gov/ntas/advisory/national-terrorism-advisory-system-bulletin-november-30-2022](https://www.dhs.gov/ntas/advisory/national-terrorism-advisory-system-bulletin-november-30-2022).

13. Office of the Director of National Intelligence. “The Future of Terrorism: Diverse Actors, Fraying International Efforts.” Global Trends – A More Contested World. March 2021. [dni.gov/index.php/gt2040-home/emerging-dynamics/international-dynamics/the-future-of-terrorism](https://www.dni.gov/index.php/gt2040-home/emerging-dynamics/international-dynamics/the-future-of-terrorism).

In many parts of the world and within urban areas in the United States, vehicles and pedestrians share close proximity, making targets easy to find. Individuals planning an intentional vehicle attack require minimal preparation—they do not need specialized skills, advanced technology, a network, substantial funds, or a team.

In 2017 in the United States, an assailant who identified as “involuntary celibate,” or “incel,” stabbed three men at his residence before driving several blocks to locations near a university campus, where he shot at and rammed victims with his car. Ultimately, the attacker killed three people and injured 13 others.¹⁴



Vehicle-Borne Improvised Explosive Device (VBIED)

A vehicle-borne improvised explosive device (VBIED) incident involves a perpetrator using a vehicle to deliver a bomb larger than could be carried by a person. In some cases, the vehicle also serves as a ramming device to transport the bomb into a designated area for maximum damage. VBIED delivery vehicles can take many forms, such as bicycles, motorcycles, cars, or large commercial trucks. VBIED attacks can result in significant damage or destruction to infrastructure and a high number of casualties because of the explosive impacts, including the blast wave, fireball, shattering, fragmentation, secondary fragmentation, and ground shock that can affect a relatively large area. These effects can lead to lung damage, thermal burns, ear drum rupture, crush injuries, embedded shrapnel, collapsing walls and ceilings, shattered glass, infrastructure damage, and other impacts to people and property.¹⁵

Although infrequent, especially in the United States, potential VBIED incidents remain a serious concern for critical infrastructure facilities and mass gathering event security teams due to the associated potential threats, damage, and lethality.

In a recent incident on December 25, 2020, an individual placed a bomb inside a recreational vehicle (RV) and detonated it next to a communications transmission facility in downtown Nashville, Tennessee. The explosion resulted in the perpetrator’s death, injuries to eight other people, damage to 40 buildings, and communication disruptions across five states.¹⁶

The appeal of VBIEDs as an attack method stems from the availability of materials for making explosive devices, the relative ease of concealing large amounts of explosives, the simplicity of delivering the device to a target, and the abundance of available bomb-making instructional materials.¹⁷ Mitigating the threat of VBIEDs is a challenging undertaking and requires implementing appropriate standoff measures, installing blast-resistant protection for walls and windows, strategically placing queue lines away from building exteriors, and deploying effective protective barriers. Having experts render the VBIED safe is a last resort if a device is found and requires close proximity.

The most devastating VBIED attack in U.S. history occurred in April 1995, when a 5,000-lb truck bomb detonated in front of the Alfred P. Murrah Federal Building in Oklahoma City, Oklahoma. The explosion resulted in 168 fatalities, including 19 children from an on-site daycare facility, and caused injuries to hundreds more. The blast also damaged most of the nine-story facility, destroyed dozens of vehicles, and caused damage to more than 300 nearby buildings.¹⁸

14. Duke, Alan. “Timeline to ‘Retribution’: Isla Vista attacks planned over years.” CNN. May 27, 2014. <https://www.cnn.com/2014/05/26/justice/californiaelliotrodger-timeline/index.html>.

15. CISA. “Counter-IED Awareness Products.” Office for Bombing Prevention. cisa.gov/topics/physical-security/bombing-prevention/products.

16. Sayers, Devon M. “Nashville bomber was fueled by ‘stressors’ such as conspiracy theories, FBI says.” CNN. March 15, 2021. <https://www.cnn.com/2021/03/15/us/nashville-bombing-investigation-update/index.html>.

17. Executive Office of the President of the United States. “Research Challenges in Combating Terrorist Use of Explosives in the United States.” Subcommittee on Domestic Improvised Explosive Devices. December 2008. <https://apps.dtic.mil/sti/citations/ADA505299>.

18. FBI. “The Oklahoma City Bombing: 20 Years Later.” April 16, 2015. fbi.gov/news/stories/the-oklahoma-city-bombing-20-years-later.

Sample Incidents Map

The consequences of vehicle rammings and VBIEDs in public spaces can be devastating, regardless of tactics or intent. Figure 2 on p. 11 illustrates the variety of incident types and motivations associated with vehicle-related incidents in the United States and Europe. A more detailed description of these incidents is provided in [Appendix A](#). The non-exhaustive list outlines incidents authorities have classified as intentional, as well as some unintentional incidents, to highlight various scenarios and potential impacts.

Unintentional Incidents

The graphic on p. 11 also includes accidental or unintentional incidents. **An accidental vehicle incident refers to vehicular harm caused by a driver who lacks malicious intent when colliding with people or critical infrastructure.** Sometimes, impairment, a medical episode, or mere distraction behind the wheel leads to an unintentional vehicle incident. These incidents, despite a lack of malicious intent, can still inflict harm. Therefore, they should be considered alongside intentional threats when assessing risk and implementing risk mitigation measures.

CISA analyzed qualitative data from the Storefront Safety Council (SSC) to assess 23,922 incidents of non-targeted vehicle ramming nationwide from 2013 to 2022.

Statistically, vehicle-to-pedestrian collisions that were not intentional represent most of the incidents in the United States. **Implementing measures to mitigate against intentional vehicle ramming incidents often yields significant safety benefits.** The SSC has tracked vehicle incidents for over a decade using open sources, court cases, insurance investigations, and other records. According to this data, more than 100 incidents, most of which are unintentional, occur every day, resulting in injuries to more than 16,000 people and causing 2,600 casualties each year. An insurance and data audit examination showed that, even with meticulous tracking, the SSC may only have captured one of every 12 incidents. In short, accidental vehicle incidents and other types of vehicle crashes remain a safety concern.¹⁹

Additionally, malicious actors sometimes use the “smash-and-grab” tactic to commit robberies, such as to obtain firearms or other weapons, which may then be used in further violent crimes or attacks. In September 2022, for example, coordinated actors rammed vehicles into the entrances of two firearms shops and stole approximately 50 weapons.²⁰

In Seattle, Washington, alone, 2022 data indicates a car or truck crashed into a building every three and a half days, on average. Seattle’s fire department records indicate there have been 700 crashes into buildings over a 10-year period, and those were only the ones to which fire department services were called. Crashes into structures often result in casualties for drivers, as well as passengers, pedestrians and building occupants.²³

While unintentional, accidental incidents can have the same consequences as deliberate vehicle ramming incidents. For instance, in December 2021, an elderly man driving through a shopping plaza parking lot in Midlothian, Illinois, experienced a medical emergency. This caused the vehicle to accelerate out of the driver’s control, striking parked cars, fatally hitting two nearby pedestrians, and crashing into the shopping center itself.²¹ In another accidental incident in April 2023, an Illinois court awarded \$91 million to a man who lost his legs after a crash in which a driver accidentally pinned him against the outer wall of a convenience store. The incident underscored the severe impact of such accidental incidents, which can result in severe injuries or loss of life.²²

19. Storefront Safety Council. “Our Statistics.” 2022. <https://www.storefrontsafety.org/post/our-statistics>.

20. Bureau of Alcohol, Tobacco, Firearms, and Explosives. “ATF and Dearborn Heights Police Department Offer up to \$20,000 Reward for Information on FFL Burglaries.” September 12, 2022. atf.gov/news/pr/atf-and-dearborn-heights-police-department-offer-20000-reward-information-ffl-burglaries.

21. Nagy, Liz. “2 Dead, Driver Injured in Crash Outside Midlothian Secretary of State Facility.” ABC7 Eyewitness News. December 8, 2021. <https://abc7chicago.com/midlothian-il-news-secretary-of-state-crash/11312775/>.

22. Klein, Kara. “How the 7-11 Storefront Crash Settlement Highlights the Importance of Retail Safety and Perimeter Security.” Security Industry Association. February 14, 2023. <https://www.securityindustry.org/2023/02/14/how-the-7-eleven-storefront-crash-settlement-highlights-the-importance-of-perimeter-security/>.

23. Kroman, David. “How often do cars crash into buildings in Seattle? Way more than you think.” Seattle Times. February 12, 2023. <https://www.seattletimes.com/seattle-news/transportation/how-often-do-cars-crash-into-buildings-in-seattle-way-more-than-you-think/>.

SAMPLE INCIDENT TYPES AND LOCATIONS

For a description of each incident noted, click the map or scroll to [Appendix A](#).

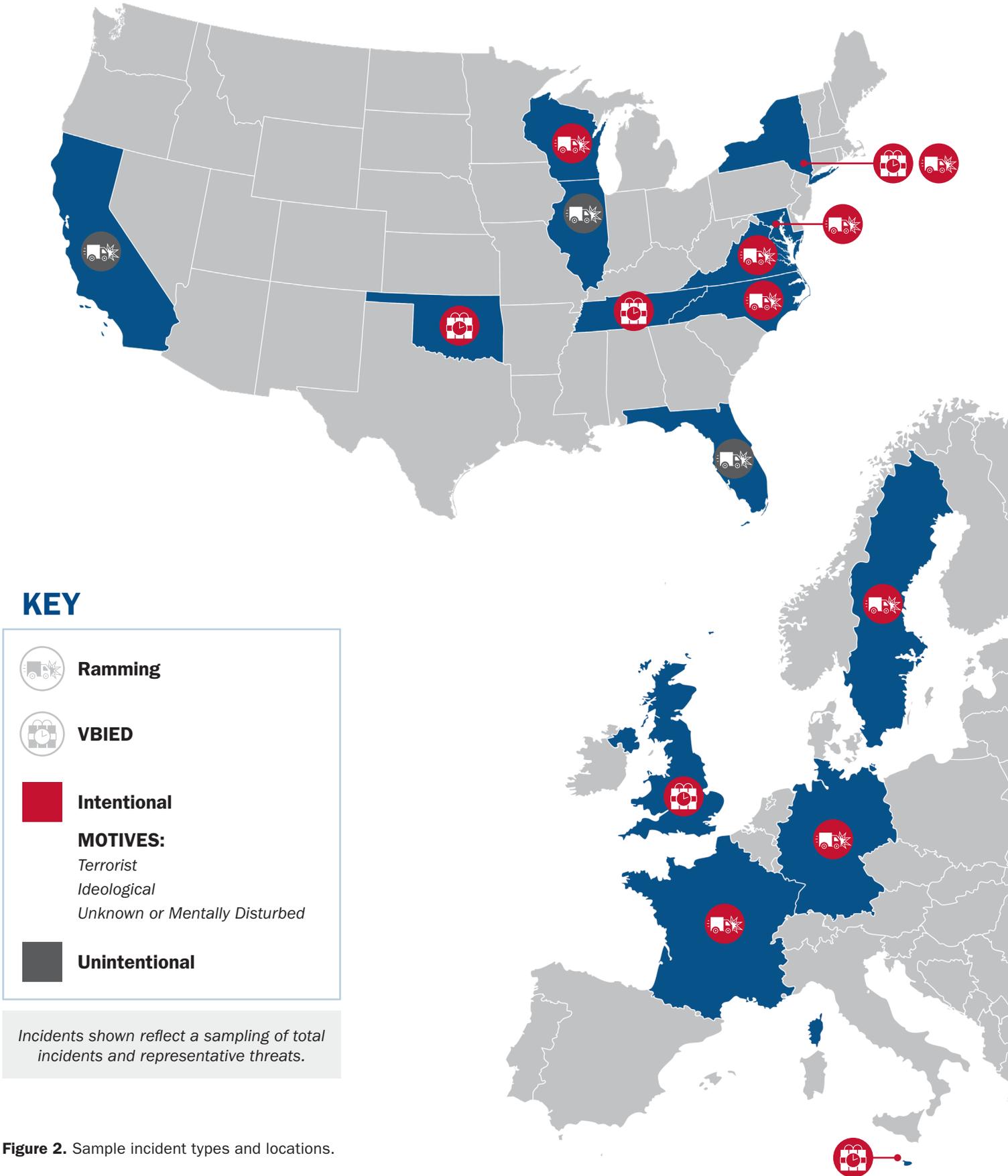


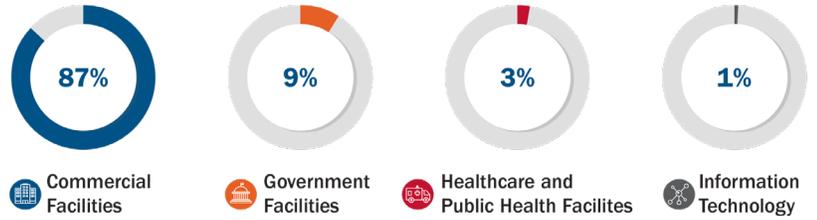
Figure 2. Sample incident types and locations.

DATA AT A GLANCE



The most **targeted critical infrastructure in the United States** is **Commercial Facilities** (including real estate and public gatherings).

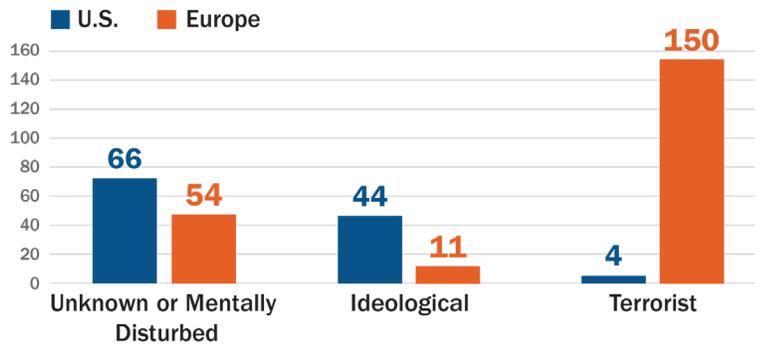
Most Targeted Infrastructure in the United States for Vehicle Ramming



The **most common U.S. perpetrator motivations** fall under the category of **Unknown/Mentally Disturbed**, followed by **Ideological**.



Analysis of Hostile Vehicle Incident Perpetrator Motivations



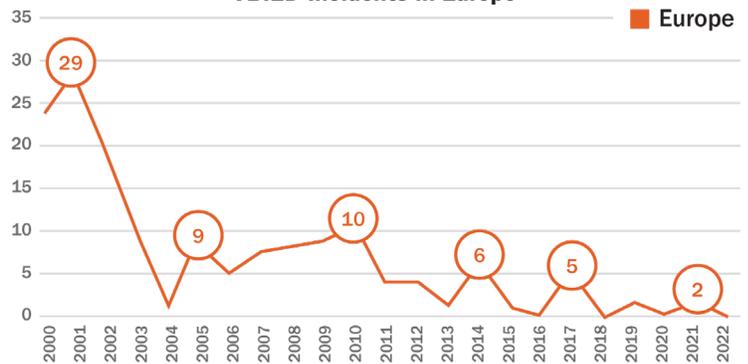
CISA categorized hostile vehicle incident perpetrator motivations in Europe and the United States by Unknown/Mentally Disturbed, Ideological, or Terrorist, assigned according to official government or other authoritative reporting.

Intentional (Targeted) VBIED in United States

Since 2000, the United States has seen three incidents that qualified as VBIED or VBIED attempts.

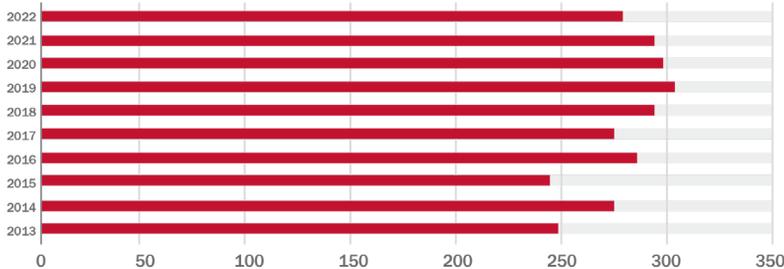
- 2004 Maui Airport, HI**
 A man set a vehicle alight with flammable liquid and drove it into the United Airlines open-air ticket counter. (*unknown/mentally disturbed motive*)
- 2010 Times Square, NY**
 A t-shirt vendor noticed and reported a running SUV; the vehicle contained a homemade bomb with 250 lbs. of fertilizer, 120 firecrackers, and 60 lbs. of propane. (*terrorist motive*)
- 2020 Nashville, TN**
 A suicidal perpetrator detonated an explosive-packed recreational vehicle in front of the AT&T building downtown; the blast killed the perpetrator, injured three people, and damaged downtown buildings. (*ideological motive*)

VBIED Incidents in Europe



VBIED has been a much more common tactic in Europe than the United States over the past two decades.

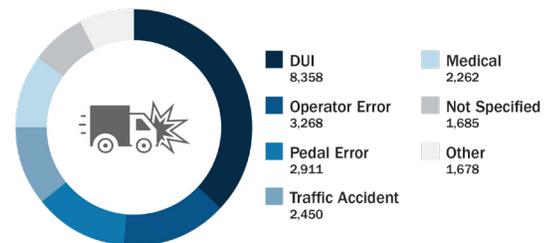
Frequency of Unintentional Vehicle Rammings



The **most common type of vehicle incident in the United States** is **unintentional rammings**. As with intentional ramming incidents, drivers unintentionally crash most frequently into commercial facilities and public settings.

Figure 3. Data at a glance.

Causes of Unintentional Vehicle Ramming



The **most common reason behind unintentional vehicle ramming** is **driving under the influence**, followed by **operator error**.

PROTEST-RELATED VEHICLE RAMMINGS | 2020

In 2020, the United States witnessed an unusually high number of incidents involving vehicles colliding with pedestrians during protests and social conflicts. Determining driver motivations proved challenging. While not all drivers exhibited hostile or intentional behaviors, some incidents originated from what analysts characterized as “malicious intent.” Researchers in one key study determined that a significant percentage of the studied incidents were either “clearly” or “possibly” motivated by malicious intent. Other studies outside of this dataset revealed an even higher correlation.

The “malicious intent” identifier serves as an umbrella term for incidents—which are different than those typically referred to as “attacks” or the narrowly defined term of terrorism—in that many drivers were animated by emotion but not necessarily attempting to cause fatalities. Such incidents include those in which drivers panicked due to boisterous, hostile, or angry crowds around them. In some cases, drivers were blocked or perceived a personal threat from the crowd and became frustrated, aggressive, or belligerent amid the events unfolding at the time. Whether those drivers were associated with any form of extremism or hostile ideology was often unclear, with reporting remaining incomplete. It is also unclear whether any hostile or crude messaging or memes circulating on social media influenced these incidents.

Key Takeaways:

Vehicle-into-pedestrian contact has consequences for both drivers and those who are struck, regardless of their motivations.

When a vehicle impacts people, they are very likely to be harmed; drivers will also likely face challenging consequences even if they had no intent beyond escaping the situation.

Proper planning and protection are critical, particularly when planning for future demonstrations. Many demonstrations in 2020 were spontaneous, with large crowds converging at locations shared through social media. Some of these locations lacked security measures. While some demonstrations were planned, barriers meant to block traffic near demonstrators were at times inadequately positioned, allowing cars to bypass them and ram pedestrians.

Organizers should work with local authorities to define the time and location for intended demonstrations and ensure appropriate security measures are in place. Local authorities can assist with road closures or deploy suitable barriers to obstruct or limit access to the event area. Law enforcement can rapidly deploy portable barriers or use city vehicles to block traffic, even in dynamic situations. If the event planning timeline is compressed, demonstrators should gather in areas already safeguarded from traffic, such as parks, barrier-enclosed pedestrian-only streets, or open-air venues.

For a deeper analysis of vehicle-to-pedestrian incidents and to review specific data, please refer to the Mineta Transportation Institute’s comprehensive October 2020 report, [Metal Against Marchers: An Analysis of Recent Incidents Involving Vehicle Assaults at U.S. Political Protests and Rallies](#).

“Hostility, more than political aims, seems to drive the confrontations and collisions against protesters. There is little evidence of planning. The malicious attacks display emotion, anger, and contempt for the protesters and their causes, but the encounters appear to be more about intimidation than about premeditated murder, and while there have been numerous injuries, there have only been two deaths, and one more possible accidental death. However, the potential for the loss of life—and in possibly great numbers under the circumstances—is clear.”

—Excerpt from *Metal Against Marchers: An Analysis of Recent Incidents Involving Vehicle Assaults at U.S. Political Protests and Rallies*

Emerging Threat Awareness: Autonomous Vehicles

The automotive industry is rapidly advancing capabilities in both cars and trucks, ranging from non-autonomous to fully autonomous vehicles (FAVs) in anticipation of widespread intelligent transportation systems (ITS) around the world. FAVs are expected to help increase efficiencies across county, state, and local transportation systems, while reducing collisions caused by drivers, ensuring comfort and safety for occupants. Advancements in autonomous systems, wireless technologies, and network connectivity bring us closer to the adoption of ITS and FAVs on a broad scale but also introduce complexities to the vehicle threat landscape.

FAVs and driver assistance technologies can increase efficiency and safety for vehicle owners, other vehicle users, pedestrians, and entire communities. However, FAVs can also be weaponized by malicious actors to remotely target individuals and infrastructure, deliver IEDs, or take passengers hostage. To serve as effective weapons, FAVs must be capable of receiving and executing instructions from both internal and external sources. Networks such as dedicated short-range communication (DSRC), long-term evolution (LTE), Wi-Fi, 5G, and Worldwide Interoperability for Microwave Access (WiMAX) are integrated into intelligent vehicle systems to enable constant communication. These networks, along with connected access platforms such as USB and Bluetooth, could provide malicious actors with remote access to a vehicle's software, allowing them to shut down or manipulate systems, potentially turning the vehicle into a deadly weapon.

The potential for weaponizing FAVs is being evaluated by governments, national agencies, industry experts, criminals, and terrorists. Testing for cyber vulnerabilities has been ongoing since 2010, when a team of researchers from the University of Washington and the University of California, San Diego, demonstrated their ability to wirelessly breach critical systems through a car's cellular connection to the telematics module. In 2015, white-hat hackers proved they could remotely disrupt a Jeep Cherokee's radio and air conditioning system.²⁴

“You could have the safest vehicle, the highest cybersecurity, and the tightest control of privacy data and still be wide open for bad actors to load the vehicle up with explosives, punch in coordinates, shut the door and send the vehicle to its destination.”

–James Niles, Chief Innovation Officer, Orbit Labs; statement to the U.S. National Highway Safety Transportation Administration²⁷

To a criminal or terrorist, FAVs may appear as the latest evolution in VBIEDs, eliminating the need for a martyr or suicide bomber. In 2018, two individuals in the United Kingdom planned to create an explosive device and attach it to a self-driving car, allowing them to cause harm to others while preserving their own lives. Fortunately, their plans were thwarted.²⁵

Autonomous vehicles use multiple sensors to interact with their environment. These sensors send data to the Advanced Driver System (ADS), which then determines where to steer, whether to increase or reduce speed, or when to stop, among many actions. These vehicles are also equipped with backup or redundant systems to ensure they respond appropriately to the environment or situation. Any manipulation or disruption to the sensors or ADS software can result in the ADS failing to respond appropriately, potentially causing an accident.²⁶

24. Greenberg, Andy. “Hackers Remotely Kill a Jeep on the Highway—With Me in It.” WIRED. July 21, 2013. <https://www.wired.com/2015/07/hackersremotely-kill-jeep-highway/>.

25. BBC News. “UK terror plot accused: Men planned ‘driverless car’ attack.” BBC.com. September 4, 2018. <https://www.bbc.com/news/uk-england-southyorkshire-45409925>.

26. National Transportation Safety Board. “Highway Accident Report: Collision Between Vehicle Controlled by Developmental Automated Driving System and Pedestrian.” NTSB.Gov. November 2019. <https://www.nts.gov/investigations/Pages/HWY18MH010.aspx>.

27. Baker, David R. “How Self-Driving Cars Could Become Weapons of Terror.” San Francisco Chronicle. October 10, 2016. <https://www.sfchronicle.com/businessarticle/How-self-driving-cars-could-become-weapons-of-9958541.php>.

Organizations can mitigate risks associated with FAVs through prevention and mitigation measures based on their unique risk and vulnerability assessments. Many prevention and mitigation measures used to counter various other threats apply to FAVs, such as identifying suspicious individuals and vehicles and enhancing resilience or fortification. However, organizations should take additional steps to address the unique challenges related to FAVs. The first step is to assess organizational risk and vulnerabilities related to FAVs and implement corresponding mitigation measures. These risk and vulnerability assessments can help organizations of all types and sizes anticipate potential future threats, drawing on lessons learned from past non-autonomous attacks and integrating those lessons learned into current security measures.²⁸

One ongoing challenge is identifying individuals who intend to commit harm using an autonomous vehicle. FAVs are essentially a publicly accessible remote attack mechanism whereby the adversary may be miles away when planning, rehearsing, or carrying out an attack.

While the current probability of a FAV threat may be lower because these technologies are still evolving, the threat landscape may change as FAV availability increases on the commercial market in the coming years. To reduce the impact of a potential FAV incident, organizations should consider implementing dual-use (non-autonomous and autonomous vehicle) mitigation measures when designing or incorporating vehicle attack mitigation measures into security planning and operations.

Resources

CISA Protecting Infrastructure During Public Demonstrations Fact Sheet	The Protecting Infrastructure During Public Demonstrations Fact Sheet offers security recommendations for businesses that may be targeted during public demonstrations. The product offers options for consideration to mitigate risk and lists CISA resources to support decision-making. cisa.gov/resources-tools/resources/patron-protection-resources .
CISA OBP Counter-IED Awareness Products	OBP provides many awareness products including cards, posters, checklists, guides, videos, briefings, and applications. These products share Counter-Improvised Explosive Device (C-IED) awareness information to help prevent, protect against, respond to, and mitigate bombing incidents. cisa.gov/topics/physical-security/bombing-prevention/products .
CISA Vehicle Ramming Action Guide	The guide provides an overview of warning signs an individual might exhibit when planning a vehicle ramming attack. It also includes suggested mitigation strategies and protective measures. cisa.gov/resources-tools/resources/vehicle-ramming-action-guide .
CISA Autonomous Ground Vehicle Security Guide	The guide provides Transportation Systems Sector partners with a framework to better understand cyber-physical threats related to autonomous ground vehicles and recommended strategies to mitigate both enterprise- and asset-level security risks. cisa.gov/resources-tools/resources/autonomous-ground-vehicle-security-guide .

28. Knopf, Kevin S. "Fully Autonomous Vehicle-Borne Improvised Explosive Devices—Mitigating Strategies." p.48. Naval Postgraduate School (U.S.), Center for Homeland Defense and Security. March 2019. <https://www.hsdl.org/?abstract&did=825210>.



2 PLAN

KEY POINTS

- Risk assessment for vehicle rammings and VBIEDs is a critical starting point for identifying vulnerabilities.
- CISA's Vehicle Ramming Self-Assessment Tool is a free, user-friendly tool to assess risk.
- CISA's Office for Bombing Prevention (OBP) provides free capacity-building resources for VBIED risk assessment and mitigation.
- Emergency Operations Plans (EOPs) for facilities and events are essential for mitigating vehicle incident threats.
- CISA Protective Security Advisors (PSAs) can provide risk assessment and emergency planning assistance.
- Developing a business case and exploring grant opportunities can help organizations access funding for security improvements.



VEHICLE RAMMING RISK ASSESSMENT

The initial step in mitigation planning is performing a risk assessment specific to vehicle-to-pedestrian contact. This assessment helps critical infrastructure owners, operators, their staff, and mass-gathering event planners identify vulnerabilities, prioritize mitigation efforts, and implement measures for pedestrian and structural security. While non-security professionals can initiate the risk assessment, it is recommended to involve trained security professionals or security design engineers when finalizing risk mitigations. When an organization understands its unique risks and vulnerabilities, it can begin identifying the people and vehicle behaviors associated with this specific threat. Planning can reduce the likelihood of an incident and, if an incident occurs despite mitigation, reduce impacts to people and property.

Planning begins with assessing risk. Risk and vulnerability assessments help:

1. Identify and evaluate potential insider, terrorist, and criminal threats and their capabilities.
2. Evaluate security protection systems and countermeasures against those threats and identify deficiencies.
3. Assess potential impacts to people and infrastructure should an incident occur.
4. Prioritize mitigation measures when applying for grants or other funding to support purchasing prevention, protection, mitigation, response, or recovery tools and resources.

The vehicle-borne threat assessment is unique in that the user assesses whether the land directly around, adjacent to, and adjoining their site or infrastructure can be a pathway for a vehicle incident.

Questions to ask during an assessment could include:

- Is my land, the adjacent land, or the surrounding land traversable by vehicles?
- What types of vehicles could traverse the land?
- What is the maximum speed a vehicle could attain going over the land?
- Is there an entry control point for vehicles? If so, how far from infrastructure is it located?
- Are there security guards at entry control points?
- Where are vehicle parking spots, lots, or garages?
- Are there any delivery vehicle access points?
- Are there any natural vehicle barriers already in place?
- What angles of attack could a vehicle use to harm my infrastructure?
- Are there any traffic-calming areas?
- Are there security cameras that cover areas where vehicles are present or will/could be traversing?
- Is pedestrian traffic, whether from parking areas or near facility entry/exit points, properly separated from vehicular traffic?

Various assessment tools—from self-assessments and vehicle dynamics assessments to assisted assessments—are available to help determine an organization’s risk of and vulnerability to vehicle incidents.

Vehicle Ramming Self-Assessment Tool

CISA developed the [Vehicle Ramming Self-Assessment Tool](#) in partnership with the Chicago Police Department's Crime Prevention and Information Center. The tool helps critical infrastructure stakeholders evaluate singular or multiple areas of interest, prioritize them by vulnerability, and identify mitigation options. It also allows stakeholders to develop a risk mitigation strategy based on their unique vulnerabilities. As part of a comprehensive security strategy, the tool can inform cost-effective decision-making and support security capacity-building efforts.



What is it?

The Vehicle Ramming Self-Assessment Tool is a web-based resource comprised of a series of simple questions that evaluate various components of a facility to assess potential vulnerabilities to a vehicle ramming attack. Based on responses, the tool provides recommended actions to reduce risk; it also includes access to a multitude of informational resources.

Does the tool collect my information?

The tool is a standalone, downloadable resource that does not collect or store users' information. Once downloaded, the tool is fully operational solely on the user's computer.

Can I save my data?

Users can export data several ways to help document a plan of action to address identified vulnerabilities.

How does the tool work?

The tool contains a series of questions relating to the location of a facility and its accessibility. As users input answers to simple questions, the tool generates risk ratings for each area of interest. A prioritization scale is leveraged to allow the user to address areas of most consequence in sequence. The tool also allows users to develop a risk mitigation strategy based on selected vulnerabilities and corresponding protective measures.

How can I access the tool?

Use the QR code or visit cisa.gov/vehicle-ramming-attack-mitigation to access the tool and other related resources.



Figure 4. What is the Vehicle Ramming Self-Assessment Tool?

Stakeholders input areas of interest and answer all questions across three evaluation categories: Environmental Characteristics, Vehicle Characteristics, and Pedestrian Factors. After entering all data and answering corresponding questions for each area, users proceed to the Vulnerabilities and Options for Consideration (VOFCs) tab. Here, users can select an area of interest and review vulnerability categories (entrance openings, openings along the street, and crowd management), prioritization scale rating, and options to mitigate vulnerabilities.

From the Results tab, users can view a simplified version of prioritization scale ratings for each area of interest:

Table 1. Vehicle Ramming Self-Assessment Tool results tab.

Elevated Concern	Areas of interest in this category usually have problems related to both vehicle size and pedestrian factors. Mitigation in this category will likely be more complex and depend on various factors.	76-100
Moderate Concern	Areas of interest in this category likely have problems in either vehicle size or pedestrian factors. Mitigation efforts may focus more heavily on one aspect of the problem.	51-75
Some Concern	Areas of interest in this level likely do not require immediate action but may benefit from general mitigation efforts. If there are areas of interest in other levels of concern, they should be considered first.	0-50

Self-assessment score results are prioritized based on a scale of some concern, moderate concern, and elevated concern. This scale allows the user and security planning team to prioritize tasks based on level of concern, problem area, and their organization’s operational needs/resource constraints. Areas of interest categorized as moderate concern likely relate to either vehicle size or pedestrian factors, whereas areas of interest with elevated concern usually relate to both vehicle size and pedestrian factors. The tool allows each stakeholder to develop a risk mitigation strategy based on their identified vulnerabilities and options for consideration.

The tool also provides stakeholders with several resources in the Information and Resources tab. These resources provide a starting point to learn more about vehicle barriers and/or crowd management to help mitigate the risk of a vehicle ramming incident. Non-security professionals, critical infrastructure owners and operators, and security professionals can explore barrier categories, selection, and deployment with corresponding references. They will also find discussion of special event vehicle ramming mitigation strategies, as well as considerations for high-speed avenues of approach.

Following completion of the self-assessment, the user can export a customized report in a variety of configurations to make it available for organizational use. The MS Word export feature allows the user to add photos, tables, graphs, and any other desired inputs. The report is not intended to be a finished product but rather a starting point for further security planning.

VBIED RISK ASSESSMENT

The vehicle ramming risk assessment process (including the Vehicle Ramming Self-Assessment Tool referenced above) provides awareness of vulnerabilities and mitigation options that also apply to VBIEDs. However, explosives prevention, detection, and mitigation encompass a larger set of concerns and variables that bear close examination by a trained professional.

OBP employs several programs that develop and deliver a diverse curriculum of training and awareness products. The products intend to build nationwide C-IED core capabilities and enhance awareness of terrorist threats. OBP seeks to enhance the nation’s ability to prevent, protect against, respond to, and mitigate the use of explosives against critical infrastructure, private sector, and federal, state, local, tribal, and territorial entities.

OBP's [Security and Resilience Guide](#) and sector-specific annexes help users:

- Understand the IED risk landscape in the United States and their locale, including essential characteristics of IEDs and IED incidents.
- Apply common IED-specific security and resilience goals and tasks designed to prevent incidents from occurring, protect people and infrastructure, and help respond and recover safely.
- Leverage available federal programs to build and sustain preparedness (e.g., through technical assistance and grant programs for training, information sharing, planning, exercises, personnel, and equipment).

The [Technical Resource for Incident Prevention \(TRIPwire\)](#) is DHS's collaborative information-sharing and resource portal.

For a deeper look into OBP's capacity-building resources, contact central@cisa.dhs.gov.

EMERGENCY OPERATIONS PLAN

Critical infrastructure owners should develop EOPs that outline their facility structure and processes to prepare for, respond to, and recover from an incident. An EOP should take an "all hazards" approach to help an organization prepare for a range of emergencies, including vehicle incidents, varying in scale, duration, and cause.

Each site and organization is unique and presents different challenges and considerations when creating an EOP. Due to the variable nature of vehicles used as weapons, organizations should prepare for the possibility of a vehicle ramming incident and VBIED. This preparation also yields corollary protection from accidental incident hazards.

CISA PROTECTIVE SECURITY ADVISOR (PSA) ASSISTANCE

CISA [PSAs](#) support organizations with [Critical Infrastructure Vulnerability Assessments](#). PSAs are physical security experts who engage with federal, state, local, tribal, and territorial governments, as well as the private sector, to help protect critical infrastructure. They can advise and recommend best practices for planning, including risk assessments and drafting EOPs. PSAs also respond to incidents, coordinate training and awareness, and plan, coordinate, and conduct security surveys and assessments.²⁹

THE BUSINESS CASE FOR SECURITY

As part of the planning process, organizations should explore security investments ahead of a potential incident. Some key mitigation measures can be costly, and depending on the size of your organization, funds for security expenditures may be limited. Amid competing financial priorities, investments in security measures are crucial for operational continuity, employee safety, and organizational resilience.³⁰

The cost of recovering from an incident can be higher than the cost of prevention. Costs associated with restoring a damaged reputation or loss of public trust are often difficult to quantify. CISA's [The Business Case for Security Infographic](#) provides a starting point for presenting security requirements and investment justifications to organizational leadership.

29. CISA. "Security Advisors." [cisa.gov/protective-security-advisors](https://www.cisa.gov/protective-security-advisors).

30. CISA. "The Business Case for Security." Last updated August 12, 2021. [cisa.gov/resources-tools/resources/business-case-security](https://www.cisa.gov/resources-tools/resources/business-case-security).

Grant and Funding Opportunities

Funding assistance is often available through grants or other funding programs from federal, state, local, tribal, and territorial governments and for 501(c)(3) organizations for target hardening and other security enhancements. Some industry associations—also known as trade associations, industry trade groups, business associations, sector associations, and industry bodies—can assist with identifying funding opportunities, identifying hazards, and providing helpful resources. Most available funding is based on an organization’s risk and vulnerability assessment. CISA offers free assessment tools that can be completed independently or with assistance from a CISA PSA. See [Chapter 3](#) for additional information on assessments.

The Federal Emergency Management Agency (FEMA) grant program provides information on pre- and post-emergency or disaster-related grant funding, how to get a grant, and helpful tools and information to apply for grants. For more information on these resources, visit [Grants.gov](#) to explore possible funding sources. Also consider checking with your respective [State Administrative Agency](#), state Emergency Management Office, private organizations, and industry associations for information on grants or funding.

Resources

CISA Guide to Active Vehicle Barrier Specification and Selection Resources	This document outlines the process for analyzing angles of attack and maximum speeds a hostile vehicle could attain when targeting a site or building. It helps to determine the necessary minimum crash rating for vehicle barriers. cisa.gov/resources-tools/resources/guide-active-vehicle-barrier .
CISA Infrastructure Visualization Platform (IVP)	This data collection and visualization tool assists with planning. It combines immersive imagery, geospatial information, and hypermedia data of critical facilities and surrounding areas to enhance planning, protection, and response. ³¹ cisa.gov/resources-tools/services/infrastructure-visualization-platform-ivp .
CISA Mass Gathering Security Planning Tool	This tool provides event planners with a framework to begin or continue planning efforts for a mass gathering or special event. Additionally, it connects stakeholders to a suite of tools and resources from CISA and its partners. cisa.gov/resources-tools/resources/mass-gathering-security-planning-tool .
CISA Vehicle Ramming Mitigation Resources	This web page provides security capacity-building resources and tools to mitigate the risk of vehicle ramming attacks. cisa.gov/topics/physical-security/vehicle-ramming-mitigation .
FEMA Comprehensive Preparedness Guide (CPG) 101: Developing and Maintaining Emergency Operations Plans	This training can help organizations create or enhance their EOP. fema.gov/emergency-managers/national-preparedness/plan#cpg .

31. CISA. “Infrastructure Visualization Platform (IVP).” June 2023. [cisa.gov/resources-tools/services/infrastructure-visualization-platform-ivp](https://www.cisa.gov/resources-tools/services/infrastructure-visualization-platform-ivp).



3 PREVENT

KEY POINTS

- Vehicle incident mitigation should focus on keeping pedestrian and vehicle traffic physically separated by proper procedures and barriers whenever possible.
- Good crowd management practices limit mass gatherings in confined locations that might be vulnerable to vehicles.
- Individuals can take practical steps to enhance personal security from a vehicle incident.
- Organizations can take practical steps to safeguard people and infrastructure from a vehicle incident.
- Identifying concerning behaviors in individuals and suspicious vehicles can help mitigate a potential threat.
- An integral part of prevention is to have an organizational culture of reporting, in which every member is trained and empowered, and every guest instructed, to identify and properly report concerning behaviors.
- Rental company staff are particularly well-positioned to recognize concerning behaviors in individuals who may be planning an attack with a large, leased vehicle.
- Mitigation consists of using a layered approach to security, as well as implementing a secure-by-design approach.



The National Preparedness Goal “Prevention” mission area aims to “avoid or stop an imminent, threatened or actual act of terrorism.”³² As shown in [Chapter 1](#), vehicle incident threats can come from terrorists, other criminals, and careless or impaired drivers. Mitigation should be considered from several angles. It is good practice to discourage forming a vulnerable crowd wherever possible through implementing good crowd management principles. Additionally, as discussed at length below and in [Chapter 4](#), strengthen infrastructure and site security with a layered approach to incorporating mitigation tools and practices. Ideally, the best outcome for a vehicle incident is for it not to happen in the first place. Venue operators, event staff and patrons should remain vigilant in identifying concerning behaviors and suspicious vehicles. It is critical for the organization to foster a culture of positive reporting and provide easy methods for reporting such concerns.

Vehicle incident preparedness should, above all, focus on separating people and vehicles, through prevention and mitigation strategies. Prevention occurs at three levels. First, be aware of the vehicle incident threat and know your organization’s risk and vulnerabilities related to this threat. Second, recognize individuals or vehicles whose behavior causes concern, and report to the proper authorities. Third, prevent potential perpetrators from gaining access to a vehicle that could be used as a weapon.

32. FEMA. “Mission Areas and Core Capabilities.” Last updated July 20, 2020. [fema.gov/emergency-managers/national-preparedness/mission-core-capabilities](https://www.fema.gov/emergency-managers/national-preparedness/mission-core-capabilities).

CROWD MANAGEMENT

Crowds are an unavoidable part of everyday life. Crowded sidewalks outside of transportation hubs, sporting events, and other public gatherings are common features in cities worldwide. Terrorists, extremists, and other criminals sometimes see crowds as easily accessible, high-visibility opportunities. One recent analysis showed that between 2014 and 2019, the most fatal vehicle ramming incidents occurred when attackers rammed into crowded public gatherings.³³

Crowd management is the overall management of a mass gathering to maintain public safety using time, space, protective measures, and information. **Crowd control** refers to actions taken once a crowd is behaving in a disorderly manner with the goal of restoring public safety.³⁴ Ideally, a crowd is properly managed to ensure the gathering is not vulnerable to a potential vehicle incident. Organizers can take steps to limit crowd formation by considering pedestrian factors, such as crowd density and dynamics, queuing practices, and mobility issues. Avoiding an entrance or exit chokepoint is always recommended to limit opportunities to target vulnerable groups. For more information on crowd management best practices, see the DHS/FEMA Crowd Management for Sport and Special Events (MGT-475) course material and participant guide, accessible at <https://ncs4.usm.edu/mgt-475-crowd-management-for-sport-and-special-events/>.

Additional recommended practices individuals and organizations should consider to enhance safety, both before, during, and after an incident, are outlined below.

Additional Preventive Actions for Individual Consideration:

PLAN

- Create a communications plan for contacting family or friends in the event of an incident.³⁵
- Think about the typical people or vehicle behaviors you would expect to see during the event.
- Consider actions or behaviors you might deem concerning or suspicious and decide ahead of time what would prompt you to request assistance.
- Pre-determine parking or transportation arrangements that will keep you safe.

COMMUNICATE

- As the reporting campaign advises, “If You See Something, Say Something®. Immediately find a security professional or law enforcement officer and share your concerns. Explore more about Reporting in the Reporting section below.

MONITOR

- Stay alert to your surroundings. Consider reviewing CISA’s [Personal Security Considerations Action Guide](#) for tips on maintaining personal situational awareness.

ACT

- Get away from an incident by running perpendicular to the path of an approaching vehicle. Run as far away as possible to avoid any secondary incidents.
- If possible, duck into the doorway of a nearby office or store.
- If unable to run from an approaching vehicle, take cover. Position yourself behind a heavy object that can block you from the approaching vehicle and/or any flying objects.
- Re-assess your chosen response as the incident unfolds. If you were taking cover or hiding and you can now run, do so.
- If you get knocked down and cannot get up, try to curl into a protected position with knees drawn up to your chest, head against your knees, and hands covering your head.
- In the event of a secondary incident involving a malicious actor on foot, use the “Run, Hide, Fight” method as outlined in this [pocket card](#).
- Remain alert for secondary attacks, such as a VBIED followed by gunfire or an assailant with a knife.
- Once first responders arrive, follow their directions. Do not attempt to cling to or call out to first responders as they move toward the threat.

For further information on these and other best practices for individual and family safety, visit CISA’s [Vehicle Ramming – Security Awareness for Soft Targets and Crowded Places](#).

33. Jenkins, Brian Michael and Butterworth, Bruce R. “Smashing Into Crowds—An Analysis of Vehicle Ramming Attacks.” Mineta Transportation Institute Publications. November 2019. <https://transweb.sjsu.edu/research/SP1119-Vehicle-Ramming-Update>.

34. DHS. “Crowd Management for Sport and Special Events.” MGT-475, Participant Guide, p. 1-9. FEMA. June 2022.

35. FEMA. “Crisis Communications Plans.” Ready.gov. 2021. ready.gov/crisis-communications-plans.

Additional Preventive Actions for Organizational Consideration:

PLAN

- Follow risk assessment and emergency operations planning steps outlined in Chapter 2 of this guide. Train and practice with all staff—including volunteers, part-time employees, and contractors/vendors—in EOP roles and responsibilities.
- Designate and train an organization public information officer and/or team.
- Plan to manage crowd behavior to maintain public safety using time, space, protective measures, and information.
- Ensure pedestrian pathways are completely separated and properly protected from traffic lanes.
- Use padlocks, keypads, or badge systems to secure fences and gates.
- Train staff in basic first aid and STOP THE BLEED®. Pre-position medical supplies and equipment in key areas of vulnerability.
- Ensure crowds have more than one way to rapidly exit in an emergency, so they do not bottleneck in one spot and create a secondary target.
- Determine maximum crowd size and a method for enforcing it.
- Designate remote parking areas and pedestrian pick-up/drop-off points away from buildings and crowds.
- Discuss and plan for visitors that include individuals, families, adults, children, and people with access challenges and special needs.
- Discuss typical perpetrator and vehicle behaviors. Understand what is considered concerning or suspicious and when to request assistance.
- Plan for hiring extra security officers or requesting law enforcement assistance for specific events. Ensure there are adequate security personnel based on crowd size and area.
- Create distinct photo ID badges or uniforms and establish “challenge procedures” for staff to confront unauthorized persons. Consider familiarizing all employees, volunteers, event staff, and vendors with CISA’s Power of Hello and De-Escalation Series for better outcomes using non-confrontational, or “soft,” security skills.
- Locate, establish communication, and conduct mass casualty exercises, if applicable, with the nearest first responders and trauma centers.
- Consider venue areas that are prone to chokepoints or gathering crowds, such as rideshare locations, and how you will protect them. Consider placing ticketing operations inside screening locations to get attendees inside security perimeters quickly and more efficiently.
- Implement chicanes or other traffic-calming features at vehicle entry and exit areas to slow approaching vehicles. Pre-position temporary or improvised barriers for specific events, as necessary.
- Create a designated vehicle route for first responders and share it with them well ahead of any special event.

COMMUNICATE

- Clearly delineate and communicate vehicle and pedestrian access routes by using ticketing application messaging, traffic application geofencing options, and onsite/nearby signage. Also show first aid stations, fire extinguishers, directional flow for people and vehicles, emergency evacuation routes, safe locations, and restrooms.
- Share emergency egress points and exit procedures before, during, and at the end of an event, using ticket application messaging, public address announcements, and onsite signage.
- Ensure adequate communication—via signage and other methods—for locations of first aid kits, crowd management procedures, and suspicious activity reporting.
- Create a communications plan for dealing with reported threats and emergency notifications to staff and visitors.³⁶
- Coordinate notification and response plans with federal, state, and local partners through appropriate channels.
- Pre-script modifiable talking points for public information officers to use following different types of incidents and outcomes.

MONITOR

- Set up CCTV or video security systems for crowd and target monitoring.
- Put up lighting to increase visibility. Dedicate security staff strictly for watching camera feeds to detect anomalous or malicious vehicle or human activity.

36. FEMA. “Crisis Communications Plans.” Ready.gov. 2021. [ready.gov/crisis-communications-plans](https://www.ready.gov/crisis-communications-plans).

MONITOR

- Create separate, manned, and secured entry and exit areas for people and vehicles. Use temporary bollards or barriers to assist with flow and protection.
- Line the target area with fencing or barriers to establish a perimeter. Remove any objects that might block surveillance views near fencing.
- Establish manned vehicle inspection points outside of target areas.
- Require tickets for all events, even free ones, to maintain awareness of crowd numbers.
- Use other technology with CCTV for license plate detection and recognition. Check state and/or local legislation for compliance with facial recognition technology laws.
- Offer voluntary opt-in facial recognition for ticketing and other programs.
- Place Explosives Detection Canine Teams at vehicle access points, move the teams through crowds, and walk them along perimeters to monitor for potential VBIEDs or individuals that have been exposed to explosive materials.
- Instruct staff and security personnel to look for vehicles that are loitering, idling, or parking without an obvious purpose; vehicles that appear altered; or vehicles being operated clumsily or with substantial difficulty.
- Carefully monitor delivery vehicles to ensure they do not drive or idle near areas where people are gathered or deviate from their designated routes.

ACT

- Activate the organization's EOP.
- If a vehicle is deemed suspicious because a possible IED was detected, do not touch it, move away immediately and direct others to do the same. Isolate the vehicle, prevent others from approaching, and notify the appropriate authorities.³⁷
- Remain alert for secondary attacks (e.g., a VBIED followed by gunfire or an assailant with a knife).
- Once first responders arrive, follow their directions.

Remember that vehicle incidents are often rapid, fluid, and unpredictable. Remain calm and follow the lead of local first responders. Render aid as a civilian, if you are trained to do so, only when and where it is safe and appropriate.

IDENTIFYING CONCERNING BEHAVIORS AND SUSPICIOUS VEHICLES

While predicting a vehicle incident can be challenging, malicious actors often display suspicious behaviors that may indicate a pathway to violence.³⁸ Critical infrastructure owners and operators and mass gathering event planners should implement and communicate appropriate reporting mechanisms for threat management within their organizations.

In addition to unknown hostile individuals, disgruntled or radicalized employees might also commit a vehicle attack under their perceived duress. These “insider threats” can include main staff, volunteers, vendors, and contractors. Security planners should not overlook the risk of an insider committing a vehicle attack targeting crowds in the area. People who work together are best equipped to notice changes in behavior and/or concerning behaviors and activities among their peers. An organization's threat assessment can evaluate whether an individual among their personnel may be on a pathway to violence and help that individual get the help they need. Taking the step of proactive assessment can potentially prevent a targeted attack from within the ranks. For more information on internal assessment and monitoring, see CISA's Insider Threat Mitigation resources at cisa.gov/topics/physical-security/insider-threat-mitigation.

37. CISA. “Bombing Prevention.” Office for Bombing Prevention. cisa.gov/topics/physical-security/bombing-prevention.

38. CISA. “Pathway to Violence.” cisa.gov/resources-tools/resources/pathway-violence.

Though the following list is not exhaustive, some concerning behaviors and suspicious activities linked to insider threats or those who are considering conducting a vehicle attack include:³⁹

- Disgruntlement toward peers or the organization
- Changes in baseline behavior such as statements threatening violence
- Unwillingness to comply with established rules or policies
- Abusing alcohol or another substance
- Distraction or inability to focus
- Hostile behavior, including issuing threats or seeking revenge
- Fascination with previous vehicle attacks or other violent incidents
- Tampering with company-owned vehicles
- Expressions of hatred or prejudice
- Advocating violence for political, religious or ideological causes
- Circulating memes and/or threatening messages via social media or other medium

In general, organizations can train staff and visitors to be cognizant of concerning behaviors, which may be indicative of hostile intent with a vehicle. While one behavior is unlikely to be concerning, any combination of the following types of behaviors bears further scrutiny:

- Nervous or volatile behavior; looking over shoulders
- Abruptly changing behaviors when seen
- Issuing threats or making hostile gestures
- Dressing inappropriately for the weather
- Using binoculars and cameras to take notes or photographs of the facility and premises
- Monitoring work vehicles and route patterns
- Asking specific questions about security operations, events or company demographics
- Testing security or first responder response by calling in emergencies or false threats
- Wandering aimlessly or spending longer than typical wandering around a site
- Abandoning a vehicle, object or package and then leaving the area
- Deviating commercial vehicles from designated routes
- Loitering where large-capacity vehicles are parked or serviced
- Testing access control barriers such as swing or lift gates, especially off-hours

TSA and the Truck Renting and Leasing Association (TRALA) particularly note that:

*Large-capacity vehicles, specifically commercial trucks, rental trucks and vans, and buses, present an especially attractive mechanism for [vehicle] attacks for several reasons: they are plentiful; arouse little to no suspicion because their presence around and access to structures and activity centers is expected; can easily penetrate security barriers; and can inflict large-scale damage on people and infrastructure.*⁴⁰

Some assailants may try to steal or clone a commercial or government vehicle to avoid suspicion. They may also use a cloned car, truck, or van painted or decorated to impersonate legitimate businesses, law enforcement, first responder organizations, or other entities. To clone a vehicle, an assailant might imitate the paint scheme, apply decals, add technology like those used by the legitimate vehicle, or steal the authentic vehicle's license plate number or vehicle identification number.⁴¹

39. CISA. "Insider Threat Mitigation Guide." November 2020. [cisa.gov/topics/physical-security/insider-threat-mitigation](https://www.cisa.gov/topics/physical-security/insider-threat-mitigation).

40. TSA and TRALA. "Safeguarding America's Transportation System – Security Guide: Truck Rental Company Employees." 2017. [tsa.gov/sites/default/files/guidance-docs/security_guide_for_truck_rental_companies_0.pdf](https://www.tsa.gov/sites/default/files/guidance-docs/security_guide_for_truck_rental_companies_0.pdf).

41. TSA. "Trucking Counterterrorism Guide." Quick Series Publishing. 2016.

Malicious actors who clone vehicles typically also steal or mimic uniforms that correspond with the cloned vehicle's organization to gain easy access to facilities, events, or restricted areas.

The list below outlines possible signs a vehicle may be used as a weapon or as one component of an attack. While this list is not exhaustive, it contains potential indicators critical infrastructure owners and operators can share with employees and security personnel.⁴²

According to the U.S. Transportation Security Administration (TSA), a potentially hostile incursion may involve an approaching vehicle displaying some of the following characteristics:⁴³

These indicators include:

- Large-capacity rental trucks, SUVs and vans that do not comply with venue requirements or vehicle restrictions
- A vehicle with a sagging rear end beyond the capacity of its suspension and potentially loaded with attack components
- Visible wires or switches protruding from or visible inside the vehicle
- Unusual vehicle modifications, such as a heavy-duty bumper guard
- Obscured or altered vehicle or driver identification, such as license plates
- Unauthorized attempts by a vehicle to enter closed areas where crowds gather
- Driver or passenger displaying signs of stress or behavioral cues including shaking, profuse sweating, refusal to make eye contact, hand wiping or smoothing/tugging on clothes
- A driver clearly lacking the knowledge to operate the vehicle or the equipment within it
- Abandoned vehicles near critical infrastructure facilities or areas with large crowds
- Drivers who park and quickly abandon the vehicle
- Vehicles with covered or obscured windows

Potential indicators of a cloned vehicle may include:⁴⁴

- A vehicle with missing or improperly displayed registration or tags
- A vehicle registered to a specific person and not an organization
- Personalized license plates that may have a threatening or out-of-place message outside of the scope of First Amendment-protected speech
- An excessive number of decals
- Misspelled words
- Phone numbers listed on the vehicle with no connection to the displayed organization name
- Multiple or conflicting business logos on the same vehicle
- A vehicle operating at a time of day or location inconsistent with its displayed purpose
- A driver who is not knowledgeable about the company or services displayed on the vehicle
- A driver with a missing uniform or one inconsistent with the vehicle's advertised organization

42. CISA. "VBIED Identification Card: Parked Vehicles." Office for Bombing Prevention. tripwire.dhs.gov/documents/vbied-identification-card.

43. TSA. "Securing Transportation Assets (TSA)." National Operations Center of Excellence. April 5, 2016. <https://transportationops.org/publications/securing-transportation-assets-tsa>.

44. Office of the Director of National Intelligence. "Counterterrorism Guide for Public Safety Personnel." Joint Counterterrorism Assessment Team (JCAT). dni.gov/nctc/jcat/index.html.

REPORTING

Reporting is an integral part of incident prevention. This involves training all staff, volunteers, and vendors to report suspicious behaviors, and instructing visitors on the reporting process.

Organizations should foster a culture that encourages reporting, ensuring that information about observed concerning behaviors promptly reaches managers and response teams. Employees and visitors are more likely to report when they believe their reports will be taken seriously and when they see reporting as a means of potentially preventing harm to individuals, including the potential assailant. It is key to socialize this idea among personnel through policy, signage and other forms of communication.

Reporting based on an individual's race, gender, or sexual orientation or for their exercise of their First Amendment rights is prohibited for governmental entities.

If You See Something, Say Something®

Concerned individuals can make reports to supervisors, management, security personnel, or law enforcement. DHS's [If You See Something, Say Something®](#) campaign encourages individuals to report suspicious behaviors following the "5 Ws:"⁴⁵



Figure 5. If You See Something, Say Something® 5 Ws: who, what, when, where, and why.

The If You See Something, Say Something® campaign helps to frame what and how information should be reported. If reporting is required, ensure individuals are empowered to report to a more immediate body, such as onsite security or local law enforcement, that can respond to the information in the shortest amount of time.

Organizations should establish a clear internal reporting mechanism for noting concerning behaviors. For example, to whom do people report? Is there an app? Is it anonymous? For visitors to mass-gathering events, signage can serve as a reminder to report to staff or visible security personnel.

Individuals who report should be as descriptive as possible, but personal safety always comes first. Only gather details about a person's suspicious activities if it is safe to do so. If it is safe, prioritize gathering a physical description of the person exhibiting suspicious behaviors (including approximate height and weight, sex, hair color, approximate age, and clothing); the behavior and why it is concerning; and the specific location of the behavior of concern. These are some of the most helpful reporting indicators.

45. DHS. "How to Report Suspicious Activity." Last updated January 19, 2024. <https://www.dhs.gov/see-something-say-something/how-to-report-suspicious-activity>.

Considerations for Rental Company Personnel

Historically, some perpetrators who plan attacks using vehicles have chosen to rent large vans and trucks because these vehicles can cause considerably more damage to people and infrastructure. Some of the most lethal vehicle incidents on record have been carried out using rental vehicles.

Several noteworthy examples highlight instances when a perpetrator obtained a rented vehicle for greater impact in vehicular assault. Some of the most devastating examples include the following:

- The perpetrator of the 1993 Bombing of the World Trade Center, Manhattan, New York, used a rented van as a VBIED.⁴⁶
- The attacker of the 1995 Oklahoma City, Oklahoma, Alfred P. Murrah Federal Building used a rented truck as a VBIED.⁴⁷
- The man who carried out the 2016 Bastille Day attack in Nice, France, used a rented heavy cargo truck as a weapon.⁴⁸
- The assailant in Manhattan, New York, in 2017 used a rented pickup truck as a ram to harm people on a bicycle path.⁴⁹
- An attacker in Toronto, Canada, rented a full-size cargo van to carry out a ramming attack in 2018.⁵⁰

Vehicle rental company employees can be a first line of defense against malicious actors preparing to use a rented vehicle as a weapon. Employees can monitor concerning behaviors and suspicious customer activities using the non-exhaustive list below:⁵¹

- Presenting an altered, expired, temporary, or fraudulent driver's license, proof of insurance, or other identification
- Giving vague details concerning the use of a vehicle and/or acting secretive
- Asking specific questions about fuel capacity or vehicle speeds
- Giving mismatched or questionable personal details
- Insisting on paying cash or using a personal credit card in someone else's name
- Inquiring about whether vehicles can be modified with grill guards or heavy-duty springs to create additional storage areas or to increase fuel capacity or vehicle speed
- Having chemical burns or missing appendages
- Exhibiting nervousness, sweating, or a lack of eye contact

46. Lambert, Laura. "World Trade Center bombing of 1993." In Encyclopedia Britannica. Chicago, IL: Encyclopedia Britannica. February 19, 2022. <https://www.britannica.com/event/World-Trade-Center-bombing-of-1993>.

47. Jenkins, John P. "Oklahoma City Bombing." In Encyclopedia Britannica. Chicago, IL: Encyclopedia Britannica. September 28, 2001. <https://www.britannica.com/event/Oklahoma-City-bombing>.

48. Sayare, Scott. "The Untold Story of the Bastille Day Attacker." GQ. January 24, 2017. <https://www.gq.com/story/nice-france-bastille-day-attack-untold-story>.

49. Yayla, Ahmet S. "Manhattan Bike-Path Murderer Followed to the Letter ISIS' 'Terrorism for Dummies.'" The Daily Beast. November 2017. https://www.researchgate.net/publication/320805937_Manhattan_Bike-Path_Murderer_Followed_to_the_Letter_ISIS'_Latest_'Terrorism_for_Dummies.

50. Boyko, John. "2018 Toronto Van Attack." The Canadian Encyclopedia. 2021. <https://www.thecanadianencyclopedia.ca/en/article/2018-toronto-van-attack>.

51. TSA and TRALA. "Safeguarding America's Transportation System – Security Guide: Truck Rental Company Employees." 2017. tsa.gov/sites/default/files/guidance-docs/security_guide_for_truck_rental_companies_0.pdf.

FOILED VEHICLE RAMMING ATTACK | 2019

On March 27, 2019, following two years of research on vehicle ramming tactics, a Maryland man stole a rental van when the driver parked and exited the area. The would-be perpetrator aimed to emulate the 2016 high-casualty vehicle ramming incident in Nice, France. The man drove around in the stolen vehicle to assess previously identified targets for the “right” number of vulnerable pedestrians.

In the early morning hours, having eliminated other potential targets, he drove to the National Harbor shopping, concert, and casino venue in Maryland. After parking and walking around to find a high-casualty target, he settled on a popular area where he could drive onto the sidewalk. The man then broke into a nearby boat to hide and wait until crowds gathered.

In the meantime, the van’s renter discovered the van missing. He reported the theft to police and described the man and vehicle he noticed was following him earlier. Authorities located the stolen van at the National Harbor complex and waited for the thief to return. The would-be perpetrator, who hid in the boat overnight, returned to the rental van intending to carry out his attack. Officers were standing by and promptly arrested the would-be attacker.

Key Takeaways:

Detecting vehicle attacks can be challenging; organizations need tools and standard practices to prevent and mitigate the threat. This would-be perpetrator was a self-radicalized, lone actor with an unsophisticated plan, who independently decided to act. Unlike many perpetrators, he was not boasting to others or posting on the internet about his grievances or desire to commit a violent act. The lack of indicators made intervention challenging in this case.

Situational awareness, especially among individuals driving or renting heavy vehicles, is key. The van renter realized he was being followed and took note of the type, color, and parking spot of the suspicious individual’s vehicle. When he discovered the van missing, he was able to report those details to authorities.

Visible and deliberate security measures can serve as helpful deterrents. The would-be perpetrator first intended to target Dulles International Airport in Virginia, but physical security features that blocked access to crowded areas forced him to search for more accessible targets.

Vehicle ramming risk assessment is critical to mitigate potential threats. The potential lack of vehicle attack mitigation measures at National Harbor made it easier for the would-be perpetrator to find what he considered an optimal location to target pedestrians.⁵²

52. DOJ, U.S. Attorney’s Office. “Criminal Complaint: Maryland Man Charged with Interstate Transportation of a Stolen Vehicle.” District of Maryland. 2019. [justice.gov/usao-md/pr/maryland-man-charged-interstate-transportation-stolen-vehicle](https://www.justice.gov/usao-md/pr/maryland-man-charged-interstate-transportation-stolen-vehicle).

MITIGATION

To mitigate a threat, it is crucial to remember that a malicious actor intending to commit a vehicle attack views your critical infrastructure and your employees and any associated sites as targets. **“Hardening” a site means taking steps to strengthen security in and around a building or event site. These measures make the site an unappealing target due to the added risk and effort an attack would require, decreasing the likelihood of a successful attack.** Effective mitigation is generally based on a layered security approach and is most beneficial when the facility is designed or later enhanced with security in mind.

The security measures you choose should be based on your organization’s risk and vulnerability assessment and unique considerations. They should reflect the organization’s acceptable level of risk and the cost, usability, and aesthetics of each measure. Organizations should also consider applicable federal, state, or local critical infrastructure protection guidelines or statutes.

A Layered Approach

Visible security—such as guards, cameras, or barriers—projects strength and is a common and effective way to deter attacks.⁵³ However, no single mitigation measure will be one hundred percent successful. The most effective security plans integrate a variety of passive and active mitigation measures using a layered approach. Incorporating multiple measures can be expensive, but prioritizing and using a scalable, phased approach for implementation can help control costs. Security measures can be proportionate to the threat and holistically designed to be consistent with foreseeable risks.

A layered approach to physical security, sometimes referred to as defense- or security-in-depth, means implementing multiple layers of interdependent systems. Physical barriers, surveillance, security guards, and access controls can deter, detect, delay, and defend against unauthorized access to facilities, equipment, and resources.⁵⁴ The premise is that if one protection measure fails, other measures will continue to provide security. Layered security also involves processes, procedures, information sharing, and training.

Security by Design

Secure-by-design speaks to a facility’s physical structure and pedestrian-protective features. Security planners should consider how to design or retrofit their location to mitigate the vehicle threat, even for pre-existing sites. The concept of Crime Prevention through Environmental Design (CPTED) outlines the implementation of measures for defensible space, including:

- **Natural access control strategies:** Optics, whether real or implied, should create “pathways” that discourage access to areas where unfriendly traffic should not be present.
- **Natural surveillance:** Features that enhance visibility and ensure adequate lighting, among other measures.
- **Territorial reinforcement:** Fostering a sense of ownership through design elements such as plantings, surface designs and perimeter fences to discourage unwelcome and hostile actors.

These features are most easily and least expensively incorporated into the facility in the building planning and construction phases, but add-on improvements are also possible. For more information on security by design, see [ready.gov/risk-mitigation](https://www.ready.gov/risk-mitigation).

53. Global Counterterrorism Forum. “The Antalya Memorandum on the Protection of Soft Targets in a Counterterrorism Context.” GCTF Framework Documents – Soft Targets Initiative. 2017. <https://www.thegctf.org/About-us/GCTF-framework-documents>.

54. CISA. “Best Practices for Planning and Managing Physical Security Resources: An Interagency Security Committee Guide.” Interagency Security Committee. December 2015. [cisa.gov/resources-tools/groups/interagency-security-committee-isc/policies-standards-best-practices-guidance-documents-and-white-papers](https://www.cisa.gov/resources-tools/groups/interagency-security-committee-isc/policies-standards-best-practices-guidance-documents-and-white-papers).

Resources

Crowd Management

FEMA Crowd Management for Sport and Special Events MGT-475 Course and Participant Guide V.1 (June 2022)	A free, in-person training from the National Center for Spectator Sports Safety and Security (NCS4), which offers lessons and practical exercises in crowd management and crowd control to enhance public safety. https://ncs4.usm.edu/mgt-475-crowd-management-for-sport-and-special-events/ .
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First Aid

DHS STOP THE BLEED®	Trains bystanders to help in a bleeding emergency and teaches basic actions to stop life-threatening bleeding following an incident. dhs.gov/stopthebleed .
FEMA You Are the Help Until Help Arrives	A resource that instructs individuals on steps to take during emergencies to save lives until responders arrive. It also discusses what happens when you call 9-1-1, how to keep yourself and the injured safe, how to stop life-threatening bleeding, how to position the injured, and ways to provide comfort until professional help arrives. community.fema.gov/PreparednessCommunity/s/until-help-arrives?language=en_US .

Recognizing Concerning Behavior

CISA OBP Vehicle Inspection Guide	Outlines a thorough and safe procedure to inspect vehicles for explosive device components, aiming to prevent the entry of explosive devices into a site of facility. *Access to the document requires establishing a TRIPwire account. cisa.gov/resources-tools/resources/vehicle-inspection-guide .
CISA OBP VBIED Identification Card	Provides indicators of suspicious parked vehicles and details steps to take regarding a vehicle of concern. cisa.gov/resources-tools/resources/vbied-identification-card .
CISA Insider Threat Mitigation Resources	Assist organizations in identifying actions related to the Pathway to Violence and how to identify potential insider threats. cisa.gov/topics/physical-security/insider-threat-mitigation/resources-and-tools .
FBI Partners in Prevention Video and TSA Truck Rental Company Security Guide	Describes suspicious activities and threat indicators that might help observers note pre-attack planning signs. These resources also introduce employees to techniques for gathering information about suspicious individuals and reporting to management and/or law enforcement. fbi.gov/video-repository/vehicle-rentals-vehicle-ramming-013019.mp4/view .
CISA Vehicle Ramming Action Guide	Outlines potential indicators of suspicious activity, actions to take in case of a vehicle ramming attack, and mitigation strategies/protective measures. cisa.gov/resources-tools/resources/vehicle-ramming-action-guide .
CISA Employee Vigilance Through the Power of Hello	Helps employees observe and evaluate suspicious behaviors and empower them to mitigate potential risk and get help when necessary. cisa.gov/topics/physical-security/non-confrontational-techniques/power-hello .

Reporting and Communicating

DHS If You See Something, Say Something®	Provides guidance on reporting observed potentially threatening behaviors. dhs.gov/see-something-say-something .
FEMA Crisis Communications Plans	Helps with implementing a communications plan during an emergency. ready.gov/crisis-communications-plans .

Training and Exercise

CISA Tabletop Exercise Packages (CTEPs) for Critical Infrastructure	Helps stakeholders design and conduct discussion-based and operational-based exercises to enhance critical infrastructure security and resilience. CTEPs are off-the-shelf, customizable, discussion-based exercises that cover a broad array of threats, including vehicle ramming. They contain exercise material templates and a collection of references and resources. cisa.gov/resources-tools/services/stakeholder-exercises .
FEMA Homeland Security Exercise and Evaluation Program (HSEEP)	Guides organizations in designing, developing, executing, and evaluating progressive exercises appropriate to the organization's risk and capabilities. fema.gov/emergency-managers/national-preparedness/exercises/hseep .



4 PROTECT

KEY POINTS

- Implementing active and passive tools and barriers can be an effective part of mitigation against a vehicle ramming threat.
- Active and passive tools and practices to mitigate against a VBIED threat include creating distance between potential targets and authorized parking, explosives detection methods, and training programs.
- Perimeter protection devices are designed and tested to prevent vehicles from entering a protected or restricted area.
- Perimeter protection devices should be chosen and installed in accordance with authoritative standards relative to established crash and penetration ratings.
- Unrated, untested or improperly anchored barriers may not provide sufficient (or any) protection.
- Stakeholders can consider a range of suggested mitigation measures based on budget and security requirements.



VEHICLE RAMMING MITIGATION TOOLS AND PRACTICES

Protection entails the implementation of tools and practices to prevent or limit the consequences of a vehicle ramming or VBIED incident. In addition to practices noted in previous chapters, implementing active and passive tools and barriers for protection is a highly effective mitigation practice. These measures are categorized based on their characteristics:

Active: A tool or practice that is operable or moves independently (e.g., a retractable bollard or a barrier with a hinged arm).

Passive: A tool or practice that is stationary or requires effort to move (e.g., a stationary bollard or landscaping).

Deployable: A tool or practice used for short-notice events or in response to a potential threat (e.g., security staff or mobile tire-shredder).

Improvised: A tool or practice used to fill gaps in a defensible space (e.g., large construction vehicles, large dumpsters, or large portable generators).

The table on page 36 shows a list of active and passive tools and practices that can mitigate a potential vehicle threat. This list uses suggested vehicle mitigation tools and practices from CISA, the Joint Counterterrorism Assessment Team (JCAT), the Mineta Transportation Institute, FEMA, and the United Kingdom's National Protective Security Authority (NPSA). This list is not all-inclusive; it provides options for consideration and is not intended to mandate policy or direct any specific action.

The table below outlines some active vehicle ramming mitigation protective measures:

Table 2: Vehicle Ramming Active Tools and Practices.

ACTIVE Tool or Practice

<p>Perimeter Protection Devices</p> <p>Implement physical barriers designed and tested to prevent vehicles from intruding into a protected or restricted area.</p>	<p>Security Personnel</p> <p>Employ guards or law enforcement who can observe, identify and respond to suspicious behaviors from people or vehicles. Station extra security personnel to serve as a deterrent against criminals and terrorists.</p>
<p>Vehicle Inspections</p> <p>Employ bomb detection tools, driver interviews and observation skills to assess and inspect incoming traffic for the explosive threats at access control points.</p>	<p>Controlled Vehicle Inclusion</p> <p>Allow select vehicle traffic into a secured site, typically via a manned entry or access control point.</p>
<p>Random Security Checks</p> <p>Periodically stop incoming vehicles at entry control or access control points and inspect for suspicious activities and objects.</p>	<p>Manned or Electric Entry or Access Control Point</p> <p>Allow vehicle entry into a secured site, checking vehicle authorization using security guards or an electronic access rights system.</p>
<p>Remote Parking/Shuttle Services</p> <p>Set up parking areas away from critical infrastructure or event areas to limit vehicle access.</p>	<p>Widened Security Perimeter</p> <p>Temporarily expand the outermost perimeter of a venue, event or building as a mitigation measure or in response to a threat.</p>



Meanwhile, the table below shows an array (not exhaustive) of sample passive vehicle ramming mitigation practices:

Table 3: Vehicle Ramming Passive Tools and Practices.

PASSIVE Tool or Practice	
<p>Physical barriers, bollards, gates</p> <p>Provide a hard stop for vehicles attempting to ram an area or building.</p>	<p>Spike strips or spiked dragnets</p> <p>Use abrasive strips or dragnets to stop or slow vehicles by popping the tires.</p>
<p>Traffic calming using chicanes, obstructions, or both</p> <p>Set up chicanes to reduce the speed of vehicles by creating a driveway with multiple curves or bends. Position stationary or deployable obstructions to reduce the speed of vehicles by forcing a driver to swerve to avoid them.</p>	<p>Concrete planters, sculptures, benches, fountains, trees, landscaping, other street furniture and other large, heavy objects</p> <p>Provide a hard stop for vehicles attempting to ram an area or building by placing alternatives to stationary bollards. These are considered more aesthetically pleasing than standard bollards.</p>
<p>Speed bumps, humps, or tables</p> <p>Build or implement stationary or deployable traffic-calming objects.</p>	<p>Total traffic exclusion</p> <p>Place barriers, bollards, and/or fencing, etc. to stop traffic flow to a site or building completely.</p>
<p>Closed Circuit Television (CCTV) or surveillance video</p> <p>Use video surveillance systems to cover streets, buildings and events. Video can be live or recorded and used for malicious vehicle or person detection, depending on local laws.</p>	<p>Pedestrian barriers</p> <p>Set up fences or barriers to direct pedestrians to cross between streets and sidewalks in secure and designated areas.</p>
<p>Fencing</p> <p>Install a protection zone boundary to assist in controlling vehicle traffic by limiting access to a facility or site. This can support detection and assessment measures by providing a means to attach detection systems, surveillance systems and lighting.</p>	<p>Tiger traps</p> <p>Build sidewalks that can withstand the weight of pedestrians or bicycles but will collapse under the weight of a vehicle, trapping the vehicle.</p>
<p>Behavioral detection technology</p> <p>Use technology designed to detect signs of stress, nervousness and suspicious behaviors. This technology can be particularly useful in dealing with insider threats or large crowds.</p>	<p>Reinforced building structure</p> <p>Use construction materials to harden a facility against vehicle ramming or VBIED. Examples include using reinforced concrete or steel frames, non-glazed cladding materials that will provide protection from fragmentation, installing protected spaces and evacuation routes that have increased protection from blast and fragments, and using security-grade external windows.</p>
<p>Signs</p> <p>Post signs that identify prohibited areas, ingress and egress, traffic flow and on-site security measures.</p>	<p>Information sharing</p> <p>Report something to law enforcement and industry partners if you hear or see something. Terrorists and criminals often leak information about targets or try dry runs at similar facilities, especially online.</p>

Mounted barriers require proper design and installation on the appropriate foundation and should meet current crash rating standards.⁵⁵ They also require regular maintenance to ensure crashworthiness. Investigate the installation site and procedures to ensure ground conditions suit the barrier anchoring.

When designing measures to mitigate vehicle ramming incidents, consider impact angles. Generally, 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. To address this, consider eliminating head-on impact approaches to make them angled or, at best, in-turn.

Additionally, implement deflections where possible to slow or limit the energy potential of approaching vehicles. This can be achieved with longitudinal deflections such as bends or chicanes to slow vehicles on approach to a crowded event. Another viable option is incorporating inclines, which can limit a vehicle's ability to gain or maintain speed. In general, the steeper the incline, the more effective it is at slowing vehicle approach speed.⁵⁶

While the measures noted above primarily apply to vehicle ramming mitigation, some of them are also applicable for VBIED mitigation. Some active and passive VBIED mitigation measures (again, not an exhaustive list) are shown in the following table:

Table 4: VBIED Mitigation Tools and Practices (Active and Passive).

VBIED MITIGATION TOOLS AND PRACTICES (ACTIVE AND PASSIVE)

<p>Enforced standoff between potential targets and authorized parking</p> <p>Use mirrors to check under vehicles and explosives detection canines to locate hidden devices. OBP can provide detailed training on inspection procedures for all types of vehicles, from sedans to large cargo trucks, upon request at obp@cisa.dhs.gov.</p>	<p>Explosives detection canine teams</p> <p>Employ Explosives Detection Canines with handlers trained in conventional explosives detection and/or person screening. Conventional explosives detection canines can be used at checkpoints or in parking lots to screen vehicles or packages for explosive materials. Person screening canines can move through crowds to detect trace odors of explosive materials.</p>	<p>Monitoring of VBIED trends and tactics</p> <p>Review all-source reporting on threats provided by the U.S. Government. Use internet-based information sharing systems and update mitigation strategies as needed.</p>
<p>Pedestrian-friendly streetscapes, physical security measures and conventional traffic principles</p> <p>Prevent vehicles' access or limit proximity to a site by closing as many roads around the event as possible.</p>	<p>Increased evacuation distance from VBIEDs</p> <p>Improve survivability from blast pressure associated with detonation.</p>	<p>Vehicle blocking (e.g., dump trucks or larger commercial or industrial vehicles)</p> <p>Limit the access of vehicles with IEDs and their proximity to a site.</p>
<p>Bomb detection devices</p> <p>Use technology that can detect bombs or bomb-making materials. These tools are typically employed by law enforcement or specialized security teams.</p>	<p>Enhanced visual inspection methods</p> <p>Look for VBIED components and devices may hidden within specialized compartments or void spaces within a vehicle or under items that may seem to have an innocuous, legitimate purpose.</p>	<p>Information sharing</p> <p>Say something to law enforcement and industry partners if you hear or see something suspicious. Terrorists and criminals often leak information online about targets for dry runs at similar facilities.</p>

55. International Organization of Standardization. "ISO 22343-1:2023 Security and resilience. Vehicle Security Barriers. Part 1: Performance requirement, vehicle impact test method and performance rating." September 2023. <https://www.iso.org/standard/50080.html>. Standards documents typically reside behind a paywall.

56. Commonwealth of Australia. "Hostile Vehicle Guidelines for Crowded Places: A Guide for Owners, Operators and Designers." Australian Government, Australian National Security – Crowded Places. Last updated November 11, 2021. <https://www.nationalsecurity.gov.au/crowded-places-subsite/Files/hostile-vehicle-guidelines-crowded-places.pdf>.

Whatever tools or practices you choose, take proactive steps to enhance your venue's security and resilience for ramming or bombing incidents in a manner that aligns with broader all-hazards preparedness and risk management principles.⁵⁷

Training practices are key to limiting the threat and potential impacts of a VBIED.

Per OBP guidance, if a vehicle's or vehicle operator's behavior is deemed suspicious, ensure onsite personnel:

- Avoid the area. Move away to safe stand-off distances immediately and direct others to do the same.
- Isolate the suspected vehicle. Establish a perimeter with an appropriate standoff distance.
- Immediately notify appropriate emergency services. Be prepared to describe the vehicle, location, time, and placement of discovery and the actions taken to mitigate risk.

Vehicle Borne IED Identification: Parked Vehicles
OFFICE FOR BOMBING PREVENTION

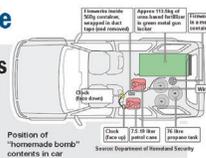
Recognize the potential indicators of a suspicious parked vehicle

Potential IED Indicators

- Heavy, sagging vehicle (rear-weighted)
- Covered or obscured windows (blankets, towels, cardboard)
- Large containers on seats or cargo area: bags, boxes, barrels, tanks
- License plates removed or altered
- Odor of propane, acids, or chemicals
- Disassociated or extraneous visible wires, switches, batteries, or antennae inside or on vehicle
- Cargo concealed with tarp or blanket that is inconsistent with vehicle use

Suspicious Behavior Threat Indicators

- Person parks and moves rapidly away from the vehicle.
- Positioned/Parked:
 - Illegally or near authorized vehicle entrances or crowded access points
 - In an area that has a known threat against it
 - In a vulnerable location (i.e. next to important building, large crowd, critical support structure, etc.)



PREVENT ★ PROTECT ★ RESPOND ★ MITIGATE

If vehicle is suspicious:

Avoid the Area

Don't touch the suspected vehicle. Instead, move away immediately and direct others to do the same.

Isolate the Suspected Vehicle

Establish a perimeter to secure the area and continue to direct people away. Use frontal and overhead cover if available. See portion of the bomb stand-off card provided.

Notify Appropriate Emergency Services

Describe the suspicious vehicle, the location of the item, the time of placement and discovery, and your actions to mitigate risk.

If vehicle is not suspicious:

- Follow local organization, agency, or jurisdiction protocol
- Treat with caution
- Attempt to locate the owner
- Notify authorities - non emergency

Threat Description	Explosives Capacity	Mandatory Evacuation Distance	Shelter-in-Place Zone	Preferred Evacuation Distance
Car	500 lbs	320 ft	321-1899 ft	+1900 ft
SUV/Truck	1,000 lbs	400 ft	401-2399 ft	+2400 ft
Small Delivery Truck	4,000 lbs	640 ft	641-3799 ft	+3800 ft
Container/Water Truck	10,000 lbs	860 ft	861-5099 ft	+5100 ft
Semi-Trailer	60,000 lbs	1570 ft	1571-9299 ft	+9300 ft

If you see something, say something®

REPORT SUSPICIOUS ACTIVITY. Contact local law enforcement or 9-1-1 in case of emergency

DEFEND TODAY, SECURE TOMORROW

"If You See Something, Say Something" used with permission of the NY Metropolitan Transportation Authority



As with any suspicious activity or imminent threat, **do not hesitate to call 9-1-1** to report to law enforcement.

Figure 6. Training practices that are key to limiting the threat and potential impacts of a VBIED.

57 CISA. "Security and Resilience Guide (SRG) and Annexes." Office for Bombing Prevention. cisa.gov/resources-tools/resources/security-and-resiliency-guide-srg-and-annexes.

ATTEMPTED VEHICLE RAMMING | 2021

On April 2, 2021, a 25-year-old man who police described as a “lone assailant” rammed his mid-size sedan into two U.S. Capitol Police officers standing guard at a vehicle barrier at the North Barricade. The vehicle struck both officers and killed one.⁵⁸ Upon striking the barrier, the driver exited the vehicle and lunged at the officers with a knife. One officer drew a weapon to shoot the man, who died shortly thereafter. The assailant’s brother later described his sibling as “paranoid and unhinged” and possibly even suicidal in the months leading up to the attack.⁵⁹

The incident highlighted both tragedy and success. The tragedy was the loss of life and significant injuries that occurred. However, the attack highlighted the benefit of the location’s vehicle barrier. Because the perpetrator’s car did not breach the barricade, it was unable to proceed further and harm more people on the Capitol grounds. The barrier was an active-type retractable metal device known as a “wedge,” installed as a VBIED-defense measure after the September 11, 2001, attacks.⁶⁰

Key Takeaways:

Properly installed vehicle barriers can deter and/or deflect oncoming hostile vehicles. Due to the wedge protection system, no vehicle has successfully penetrated the U.S. Capitol grounds or building in the post-9/11 era. Along with berms in various locations, metal detectors in buildings, and other security enhancements, the Capitol landscape reflects both unobtrusive and more obvious vehicle security mitigations.

Perpetrators often display recognizable indicators of intended violent activity. In this case, the perpetrator may have displayed behavioral indicators of a plan to harm himself or others. His brother said the man sent him a final text message the night before the incident, hinting that he was going to end his life. His writings indicated a recent spiral due to grievances he called “afflictions.”

The threat landscape remains dynamic. Though vehicle incidents have not occurred at the Capitol since enhanced security measures were implemented, threats have not disappeared. The January 6, 2021, mob insurrection illustrated that determined people on foot can still breach the premises through secured doors and windows despite an armed guard force. In addition, an individual accessed areas within blocks of the Capitol and planted two pipe bombs the night before the January 6 event. Fortunately, the IEDs did not detonate before authorities could safely respond.⁶¹

58. Cohen, Z., Fox, L., Dean, J., and Shortell, D. “Capitol Police officer killed, another injured after suspect rams car into police barrier outside building.” CNN. April 3, 2021. <https://www.cnn.com/2021/04/02/politics/us-capitol-incident/index.html>.

59. Davies, E., Jouvenal, J., and Miller, M.E. “Family and friends concerned Noah Green was unraveling before Capitol attack.” Washington Post. April 2, 2021. https://www.washingtonpost.com/local/public-safety/noah-green-capitol-attack/2021/04/02/74f75802-93fe-11eb-a74e-1f4cf89fd948_story.html.

60. Fischer, Jordan. “Capitol defenses focused on preventing another Oklahoma City, not stopping thousands of insurrectionists.” WUSA9.com. February 24, 2021. <https://www.wusa9.com/article/news/national/capitol-riots/capitol-defenses-focused-on-preventing-another-oklahoma-city-bombing-not-stopping-thousands-of-insurrectionists-trump-blanton-sund/655a4c68f6-2082-4cf2-aa09-7fbcc3b63bf5>.

61. Bennett D., Brown, E., Cahlan, S., Dawsey, J., and Sohyun Lee, J. “Pipe bombs found near Capitol on Jan. 6 are believed to have been placed the night before.” Washington Post. January 29, 2021. <https://www.washingtonpost.com/investigations/2021/01/29/pipe-bomb-suspect-video/>.

PERIMETER PROTECTION DEVICES

A driver behind the wheel during a vehicle incident is unlikely to follow the rules of the road, potentially ignoring traffic signals, exceeding speed limits and penetrating other security measures. Vehicle incident assessment and mitigation measures will need to counter and/or withstand a hostile vehicle attack. Perimeter protection devices are physical barriers designed and tested to prevent vehicles from entering a protected or restricted area. If used properly, they can protect people and property from terrorist attacks such as vehicle ramming and VBIEDs, malicious activities such as vandalism and robbery, or accidental events such as storefront crash incidents. Perimeter protection devices designed and tested to protect against vehicle attacks are called (Crash and Penetration) "Rated Perimeter Protection Devices."

Such devices come in different shapes and capacities. They are engineered and tested to absorb vehicle impact energy, mitigating the risk of a vehicle ramming threat. There are a wide variety of rated perimeter protection devices such as bollards, wedge barriers and walls. These devices can be fixed in place to provide permanent protection (e.g., fixed bollard systems) or be deployable, portable or removable.

Rated perimeter protection devices are designed and tested to mitigate vehicle impact in a measured and controlled manner. An "unrated" perimeter protection device is not necessarily unable to mitigate the vehicle ramming threat. Rather, this designation indicates that the device's ability to stop a hostile threat or errant vehicle is "unknown" and should not be relied on. It is possible an unrated device could only be used for the optic of deterrence. See, for example, the delineator bollards shown in Figure 7.

Perimeter protection devices are physical barriers designed and tested to prevent vehicles from intruding into a protected or restricted area. Used properly, they can protect people and property from terrorist attacks such as vehicle ramming and VBIEDs, malicious activities such as vandalism and robbery, or accidental events such as storefront crash incidents.

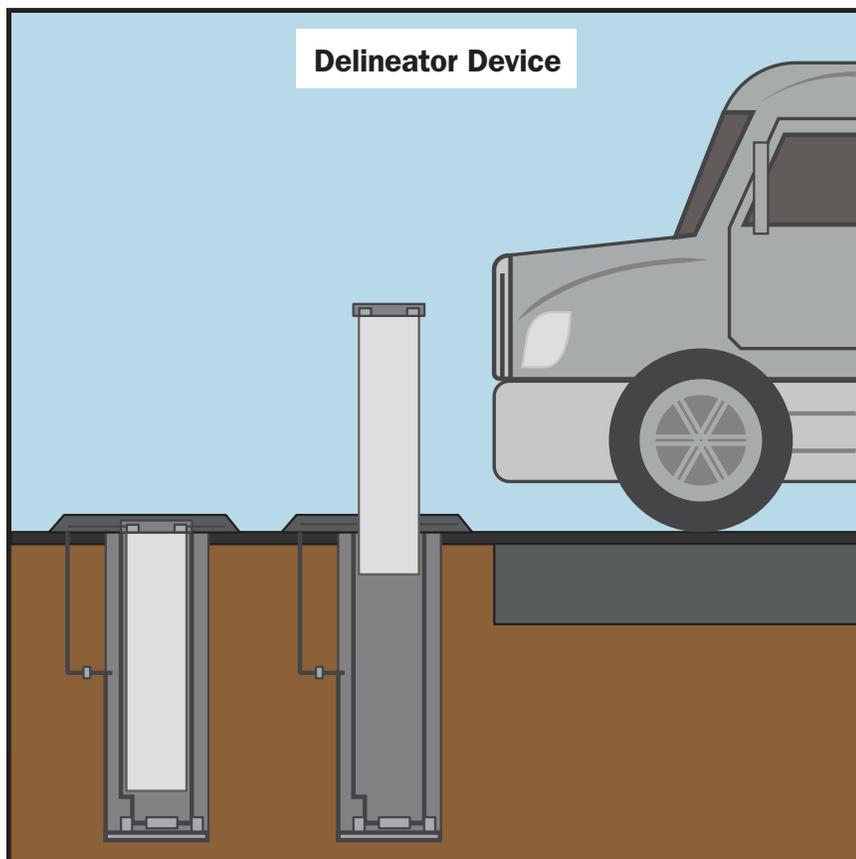


Figure 7. Delineator devices may be unrated and have limited potential to stop an approaching vehicle.

Rated bollards are comprised of metal posts supported by foundations designed and tested to mitigate vehicle rammings. See Figure 8.

Perimeter protection devices such as bollards, fences, gates, wedge, drop arm, swing arm, portable barriers, etc., come in various styles. Anti-ram, safety, architectural and landscaping styles each offer various functionalities and levels of protection based on their Crash and Penetration Ratings. They can be used to protect buildings from intentional high-speed vehicle rammings, protect pedestrian-only streets from vehicle access, or protect sidewalks from accidental vehicle mounting. See Figure 9 for an example of barriers for perimeter protection, dividing secure areas from public access, or at entry gates to control access.

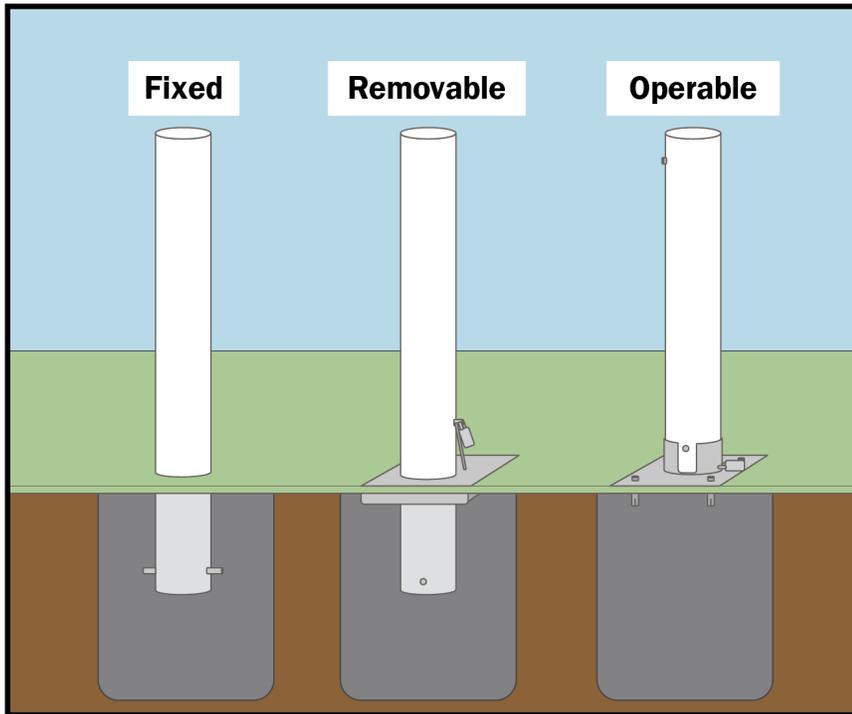


Figure 8. Rated bollards comprised of metal posts supported by foundations designed and tested to mitigate vehicle rammings. Ensure proper engineering and anchoring of bollards by qualified professionals, and inspect and maintain devices at manufacturer-identified intervals.

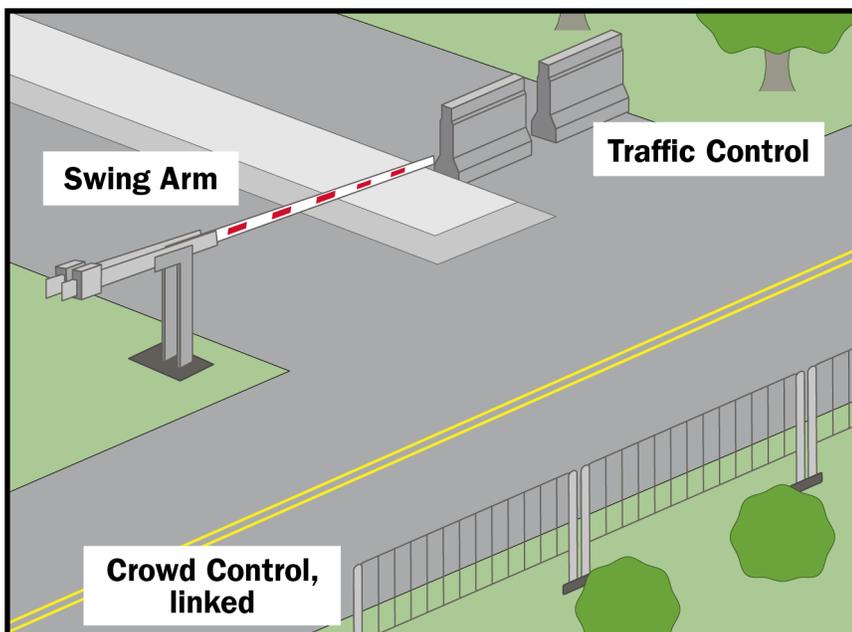


Figure 9. Barriers for perimeter protection, dividing secure areas from public access or at entry gates to control access.

As noted above, perimeter protection devices—sometimes grouped under the collective name, “protection or security barriers”—are primarily classified into two categories: active and passive. They can be staffed or unstaffed, locally or remotely controlled, and stationary or movable. Devices can be impact rated and certified based on a vehicle's impact speed, weight and penetration distance. It is key that any barrier selection and installation is tested to ensure consistency with advertised ratings. Two standards mechanisms are the American Society for Testing and Materials (ASTM) and the International Organization for Standardization (ISO). Both organizations set rules for the market of various products. ISO is a global entity into which ASTM is incorporated. In the United States, ASTM standards are generally authoritative. ISO standards provide some overlap and similarity, and ISO accredits testing operations.

The key ASTM standards for vehicle barrier vetting are ASTM F2656/F2656M-20, Standard Test Method for Crash Testing of Vehicle Security Barriers and ASTM F3016/F3016M, Standard Test Method for Surrogate Testing of Vehicle Impact Protective Devices at Low Speeds. ASTM’s ratings factor in the weight of the vehicle and its maximum speed at barrier impact to calculate the subsequent penetration capability. Evaluations, originally called “K-ratings” under the pre-2009 U.S. Department of State rating system, are compared with “M-ratings” under the ASTM F2656 standards. M-Ratings are determined as follows, with a 15,000-lb vehicle being a standard cab flatbed truck. The key ASTM standards for vehicle barrier vetting are ASTM F2656/F2656M-20, Standard Test Method for Crash Testing of Vehicle Security Barriers and ASTM F3016/F3016M, Standard Test Method for Surrogate Testing of Vehicle Impact Protective Devices at Low Speeds. ASTM’s ratings factor in the weight of the vehicle and its maximum speed at barrier impact to calculate the subsequent penetration capability.

Table 5: M-ratings with a 15,000-lb. vehicle being a standard cab flatbed truck.

Rating	Vehicle Weight	Vehicle Speed	Penetration Rating
M30	15,000 lbs.	30 mph	P1 = ≤1 m (3.3 ft) P2 = 1.01-7 m (3.31-23 ft) P3 = 7.01-30 m (23.1-98.4 ft)
M40	15,000 lbs.	40 mph	P1 = ≤1 m (3.3 ft) P2 = 1.01-7 m (3.31-23 ft) P3 = 7.01-30 m (23.1-98.4 ft)
M50	15,000 lbs.	50 mph	P1 = ≤ 1 m (3.3 ft) P2 = 1.01-7 m (3.31-23 ft) P3 = 7.01-30 m (23.1-98.4 ft)

For instance, at a location where a 15,000-lb. medium duty truck can impact the protected perimeter at 50 mph, the vehicle can penetrate 3.3 feet or fewer into the secured area. An M-50-P1 ASTM F2656-rated bollard would be recommended and installed to mitigate an incident at this location. Conducting vehicle ramming assessment can assist in determining the extent of vehicle velocity impact. A helpful reference for this type of assessment is the Army Corps of Engineers' UFC 4-022-02 (Selection and Application of Vehicle Barriers, 2023).⁶²

ASTM Vehicle Types are categorized as follows, with corollary penetration ratings identified by vehicle type and speed:

Table 6: ASTM vehicle types categorized with corollary penetration ratings identified by vehicle type and speed.

Vehicle Type	Vehicle Weight	Crash Rating	Penetration Rating
Small Passenger Car (SC)	2,430 lbs.	SC30 (30 mph)	P1 = ≤ 1 m (3.3 ft) P2 = 1.01-7 m (3.31-23 ft) P3 = 7.01-30 m (23.1-98.4 ft)
		SC40 (40 mph)	
		SC50 (50 mph)	
		Sc60 (60 mph)	
Full-Size Sedan (FS)	4,630 lbs.	FS30 (30 mph)	P1 = ≤ 1 m (3.3 ft) P2 = 1.01-7 m (3.31-23 ft) P3 = 7.01-30 m (23.1-98.4 ft)
		FS40 (40 mph)	
		FS50 (50 mph)	
		FS60 (60 mph)	
Pick-up Truck (PU)	5,070 lbs.	PU30 (30 mph)	P1 = ≤ 1 m (3.3 ft) P2 = 1.01-7 m (3.31-23 ft) P3 = 7.01-30 m (23.1-98.4 ft)
		PU40 (40 mph)	
		PU50 (50 mph)	
		PU60 (60 mph)	
Medium Duty Flatbed Truck (M)	15,000 lbs.	M-30 (30 mph)	P1 = ≤ 1 m (3.3 ft) P2 = 1.01-7 m (3.31-23 ft) P3 = 7.01-30 m (23.1-98.4 ft)
		M-40 (40 mph)	
		M-50 (50 mph)	
Heavy Goods Vehicle (H)	65,000 lbs.	H30 (30 mph)	P1 = ≤ 1 m (3.3 ft) P2 = 1.01-7 m (3.31-23 ft) P3 = 7.01-30 m (23.1-98.4 ft)
		H40 (40 mph)	
		H50 (50 mph)	
		H60 (60 mph)	

62. ASTM International. "ASTM F2656/F2656M-20 Standard Test Method for Crash Testing of Vehicle Security Barriers." April 20, 2020. <https://www.astm.org/f2656-f2656m-20.html>. Resource is behind a paywall.

ASTM Standard ASTM F3016/F3016M-19 provides crash rating thresholds for a 5,000-lb. vehicle traveling at lower speeds (30 mph or slower).

Table 7: The test is done with a test-specific, 5,000-lb. “surrogate” vehicle that has a special crumple feature in the nose.⁶³

Vehicle	Speed Rating	Penetration Rating
Surrogate Vehicle (S) (with specified crumple zone [5,000 lbs.]	S10 (10 mph)	P1 ≤ 1 ft
	S20 (20 mph)	P2 1-4 ft
	S30 (30 mph)	Failure ≥ 4 ft

Ensure proper installation of the devices regardless of the barrier selected. The following steps are recommended:

1. Conduct a vehicle ramming assessment to identify the proper barrier crash and penetration ratings.
2. Analyze, design and approve the foundation system for proposed protective device placement or installation.
 - a. Rule out the existence of underground obstructions that might interfere with the barrier foundation and anchoring system.
 - b. Observe ground conditions, such as drainage or sinkage, that could limit the crashworthiness of the barrier.
 - c. Ensure protection of any underground utilities and services close to the barrier.
3. Stay aware and current on barrier maintenance, including service requirements, repairs and obtaining spare parts.
4. Ensure controls for active barriers are securely located beyond public access.

A vetted and qualified protective design engineer can provide specifics regarding the planned installation area. Review all immediately surrounding roads and underground infrastructure, and ensure barrier plans are deemed safe for the area.⁶⁴

Be aware that not all perimeter protection devices are crash/penetration-rated and -certified. Unrated barriers can have any level of protection or none. The idea that “something is better than nothing” could create a false sense of security. Perimeter protection devices that are rated and certified help organizations accurately and efficiently determine what to purchase according to their particular security requirements.

Important terms for evaluating barrier crash test reporting:

Tested means the barrier was physically tested; it does not ensure it passed the test. Seek to obtain an authentic ISO certificate and test report.

Rated means the product was rated in accordance with ASTM F2656 standards based on the physical test.

Engineered means the product has been created, calculated, designed, and computer model-tested to a particular requirement. It does not indicate the product has been physically tested.

Equivalent means it should be verified to ensure the defined M-rated and K-rated standards are similar.

63. Reliance Foundry. “ASTM Low-Speed Crash Test Ratings: Vehicle impact protective devices S-rated for low-speed traffic.” Reliance Foundry, Ltd [blog post]. 2023. <https://www.reliance-foundry.com/blog/low-speed-crash-ratings>.

64. Commonwealth of Australia. “Hostile Vehicle Guidelines for Crowded Places: A Guide for Owners, Operators and Designers.” Australian National Security. 2017. <https://www.nationalsecurity.gov.au/protect-your-business/crowded-places/crowded-places-guidelines/hostile-vehicle-attacks>.

Determining which device is best will depend on the results of threat, risk and vulnerability assessments. See Tables 8 and 9 below for examples of passive and active perimeter protection devices.

Table 8: Passive Barriers.

System	Description	Uses
<p>Fencing—Permanent</p> 	<p>An upright, anchored structure composed of metal or other solid substance, enclosing an area to mark a boundary</p>	<p>Provide</p> <ul style="list-style-type: none"> ■ Perimeter definition ■ A means to attach lighting and surveillance equipment
<p>Fencing—Temporary</p> 	<p>A variety of types and styles; typically, freestanding panels that can be interlocked to extend their length; deployable</p>	<p>Crowd and Traffic Management</p> <ul style="list-style-type: none"> ■ Separate areas ■ Vehicle and pedestrian traffic control
<p>Bollards—Permanent</p> 	<p>A built-in vertical tube; variety of types and styles; crash rated – depending on the type; more easily blend in with architectural and landscaping features</p>	<p>Protection</p> <ul style="list-style-type: none"> ■ Inhibit vehicle intrusion ■ Vehicle and pedestrian traffic control
<p>Jersey Barriers</p> 	<p>Concrete or plastic road barriers that can be standalone, water, or sand-filled; come in a variety of styles, shapes, sizes, and construction materials; deployable</p>	<p>Protection</p> <ul style="list-style-type: none"> ■ Vehicle and pedestrian traffic control ■ Create stand-off distance
<p>Landscape Architecture</p> 	<p>Dual-purpose vegetation and hardscape; low maintenance; used where aesthetics may be important</p>	<p>Protection</p> <ul style="list-style-type: none"> ■ Inhibit vehicle intrusion ■ Vehicle and pedestrian traffic control ■ Create stand-off distance
<p>Tire Teeth or Shredder</p> 	<p>A metal strip with jagged, teeth-like edges that shreds or cuts vehicle tires; built-in or deployable</p>	<p>Prevention</p> <ul style="list-style-type: none"> ■ Prohibit wrong-way traffic ■ Deployable to puncture tires to stop a vehicle

Table 9: Active Barriers

System	Description	Uses
Gates 	Barriers, often referred to as the operable portion of fencing; can be mounted on wheels or hinges; opens and closes either manually or automatically; variety of types and styles	Security <ul style="list-style-type: none">■ Vehicle or pedestrian access control
Traffic Arm Barrier 	An arm that moves up and down to prevent or allow vehicle access; moved either manually or automatically; variety of types and styles; crash rated, depending on the type	Security <ul style="list-style-type: none">■ Vehicle access control
Retractable Bollards 	A built-in vertical tube that can be retracted into the ground to allow movement; variety of types and styles; moved either manually or automatically; crash rated – depending on the type	Protection <ul style="list-style-type: none">■ Inhibit vehicle intrusion■ Vehicle and pedestrian traffic control
Ramp-style Barrier 	A concrete or steel impediment that can be manually or automatically raised or lowered, depending on type to allow access; variety of types and styles; permanent or temporary; crash rated – depending on the type	Protection <ul style="list-style-type: none">■ Inhibit vehicle intrusion

When selecting perimeter protection devices and placement, ensure the following:

1. There is ready access for emergency responders. If barriers are immovable, pre-arrange with first responders how they will quickly gain unrestricted site access during an unplanned event.
2. Barrier placement does not create dangerous “choke points” for crowds leaving an area or venue. Consider using movable barriers that can “throttle” crowd movement appropriately.
3. Barriers fully allow safe avenues of ingress and egress from a site for people with access and functional needs.

Managing Mitigation Costs

As stated earlier in this section, buildings, sites, and venues with visible mitigation or hardening measures are less appealing to potential attackers. Organizations should prioritize mitigation measures based on risk and vulnerability assessments, and then according to return on investment (amount of protection each measure provides versus cost to implement the measure). Cost should include initial purchase price and potential installation, maintenance, or upkeep expenses. Organizations can then design a scalable, phased approach for incorporating measures into existing infrastructure or design plans.

Cost associated with mitigation measures will vary depending on site-specific requirements, but Figure 10 offers a generalized spectrum of mitigation measures ranging from least to greatest protection and cost.⁶⁵ Security planners can use this figure to find cost-effective mitigation measures until total funding is available.

Organizations can consider a range of low-to-high-cost mitigation steps, as shown in the figure below:

Figure 10. Managing Mitigation Costs



65. FEMA. "Risk Management Series - Site and Urban Design for Security; Guidance Against Potential Terrorist Attacks (FEMA 430)." Ready.gov. December 2007. [ready.gov/business/planning/risk-mitigation](https://www.ready.gov/business/planning/risk-mitigation).

Resources

<p>CISA Protecting Patrons in Outdoor Eating Venues Fact Sheet</p>	<p>The Protecting Patrons in Outdoor Eating Venues Fact Sheet offers security recommendations to restaurants that host patrons in outdoor eating areas. The product offers options for consideration to mitigate risk and lists CISA resources to support decision-making. cisa.gov/resources-tools/resources/patron-protection-resources.</p>
<p>CISA OBP Counter-IED Resources</p>	<p>Provides awareness products including cards, posters, checklists, guides, videos, briefings, and applications. These products share C-IED awareness information to help prevent, protect against, and respond to bombing incidents. cisa.gov/topics/physical-security/bombing-prevention.⁶⁶</p>
<p>CISA Vehicle Ramming Action Guide</p>	<p>Provides a high-level overview of warning signs an individual might exhibit when planning a vehicle ramming attack. It also includes suggested mitigation strategies and protective measures. cisa.gov/resources-tools/resources/vehicle-ramming-action-guide.</p>
<p>CISA Guide to Active Vehicle Barrier Specification and Selection Resources</p>	<p>Provides information to help engineers, policy makers, security managers, intelligence analysts, and other security professionals successfully determine Active Vehicle Barrier (AVB) specifications and select appropriate AVB models for a particular site requiring restricted access. cisa.gov/resources-tools/resources/guide-active-vehicle-barrier.</p>
<p>CISA OBP Security and Resilience Guide: Counter-Improvised Explosive Device (C-IED) Concepts, Common Goals, and Available Assistance (SRG C-IED)</p>	<p>Assists stakeholders in planning and implementing C-IED activities within their overall public safety and emergency management approach. cisa.gov/resources-tools/resources/security-and-resiliency-guide-srg-and-annexes.</p>
<p>CISA Personal Security Considerations Action Guide</p>	<p>Encourages critical infrastructure owners and operators and their personnel to remain vigilant and report suspicious behaviors to thwart an attack. It also contains several easily implementable security measures that can mitigate threats to personal safety. cisa.gov/resources-tools/resources/personal-security-considerations-action-guide.</p>
<p>CISA Active Shooter Emergency Action Plan Guide Resources</p>	<p>This web page contains a full guide, emergency action template and video with trailer for emergency action planning. cisa.gov/resources-tools/resources/active-shooter-emergency-action-plan-product-suite.</p>

66. CISA. "Bombing Prevention." Office for Bombing Prevention. [cisa.gov/topics/physical-security/bombing-prevention](https://www.cisa.gov/topics/physical-security/bombing-prevention).



5 CONCLUSION

Vehicle incidents are an unfortunate occurrence in today's rapidly evolving and complex threat landscape. Malicious actors using vehicles as weapons continue to pose a significant threat to people and property. This threat directly correlates with the ease of executing this type of attack, coupled with the attention these attacks tend to garner. Like other threat vectors, one "successful" vehicle incident can encourage other perpetrators to try the same tactic.

While all organizations hold the hope that a vehicle incident, whether it is intentional ramming, accidental incident or a VBIED, will never occur at their facilities or events, relying solely on hope is not a plan. The best opportunity to prevent an incident is before it happens. The implementation of planning, preventive, and protective measures offers the best chance to limit consequences and damage.

As demonstrated in this guide, unintentional vehicle rammings also have the potential to cause significant harm to people and infrastructure. To address the overall vehicle threat, organizations should implement a comprehensive security strategy and plan to safeguard people and infrastructure.

WHERE TO BEGIN

Shoring up your facility's vehicle incident prevention and mitigation posture can be overwhelming. To sum up this Guide's recommendations, consider starting with the following action items:



Identify key assets and the unique characteristics of your facility for consideration of vehicle incident possibilities.

Identify and assess threats in your facility's environment.



Conduct a vulnerability analysis. For assistance on this step, seek the assistance of a security professional.

Conduct a consequence analysis. What could happen? How bad could it be?



Prioritize and implement countermeasures, seeking the assistance of a security professional as needed.

Vehicle incidents are devastating under any circumstances. While not always preventable, the likelihood and impact of such an occurrence can be reduced through proper awareness, planning, protection, and action to help safeguard people and property.

APPENDIX A

SELECTED SIGNIFICANT VEHICLE RAMMING AND VBIED INCIDENTS

The following list is not exhaustive but provides an overview of some significant vehicle incidents to illustrate the varied types, locations and motivations of perpetrators. Incidents here are selected due to the high number of deaths or injuries that resulted, the widespread media attention the incident garnered and/or the high profile of the incident location.

VEHICLE RAMMING INCIDENTS

Chapel Hill, North Carolina In February 2006, a recent graduate of the University of North Carolina at Chapel Hill targeted a crowded, sunken brick-paved campus area with his SUV. The driver later told investigators he aimed to “target” perceived IS enemies. The incident injured nine people.⁶⁷

Nice, France On Bastille Day, July 14, 2016, an IS-affiliated actor drove a 19-ton rented cargo truck on the Promenade des Anglais in the highest-casualty ramming incident to date. The attack killed 86 people and injured more than 400 others who had gathered to watch celebratory fireworks.⁶⁸

Berlin, Germany In December 2016, an IS-affiliated actor hijacked a semi-trailer truck from a delivery company, killed its driver, and drove the truck through a crowded Christmas market. The incident killed 11 people and injured approximately 60 others.⁶⁹

Stockholm, Sweden In April 2017, an IS-affiliated man drove a hijacked brewery truck down a pedestrian street in central Stockholm, zigzagging and hitting people in the shopping area there. His actions killed four people and injured 15 more.⁷⁰

Charlottesville, Virginia In August 2017, a far-right actor committed a vehicle ramming attack against counterdemonstrators gathered at a march. The incident killed one person and injured dozens more.

New York, New York In October 2017, an IS-affiliated actor drove a rented pick-up truck onto a Lower Manhattan bicycle path, striking pedestrians and cyclists. The incident killed eight people and injured nearly a dozen.⁷¹

National Harbor, Maryland In March 2019, an IS-inspired man stole a rental van, planning to target pedestrians at the National Harbor shopping and entertainment venue near Washington, D.C. The van’s owner reported it stolen and described the individual who had followed him prior to the theft. Police intercepted the vehicle and the would-be rammer prior to his attack. The incident highlights the importance of reporting.⁷²

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67. NBC News. “Driver charged after SUV plows through crowd.” NBCnews.com. March 3, 2006. <https://www.nbcnews.com/id/wbna11660817#.V5ayxo-cGUK>.

68. The Washington Post. “The mile-long site where a truck hit hundreds in Nice, France.” WashingtonPost.com. July 16, 2016. <https://www.washingtonpost.com/graphics/world/bastille-day-truck-attack-nice-france/>.

69. Pieper, Oliver. “Germany remembers Christmas market attack victims.” DW.com. December 19, 2021. <https://www.dw.com/en/5-years-later-germany-remembers-victims-of-berlin-christmas-market-terror-attack/a-60148540>.

70. Associated Press. “Lawyer: Suspect admits ramming truck in Stockholm attack.” USA Today. April 11, 2017. <https://www.usatoday.com/story/news/world/2017/04/11/lawyer-suspect-admits-ramming-truck-stockholm-attack/100316370/>.

71. Prokupecz, S., Levenson, E., Gingras, B., and Almasy, S. “Note found near truck claims Manhattan attack done for ISIS, source says.” CNN. November 6, 2017. <https://www.cnn.com/2017/10/31/us/new-york-shots-fired/index.html>.

72. DOJ, U.S. Attorney’s Office. “Criminal Complaint: Maryland Man Charged with Interstate Transportation of a Stolen Vehicle.” District of Maryland. 2019. <https://www.justice.gov/usao-md/pr/maryland-man-charged-interstate-transportation-stolen-vehicle>.

Waukesha, Wisconsin On November 21, 2021, a criminal fleeing a domestic incident drove through temporary barricades and into a Christmas parade route. Ignoring police attempts to stop the vehicle, the driver continued down the parade route, swerving into pedestrians. Ultimately, five people died and 62 suffered injuries.⁷³

VEHICLE-BORNE IMPROVISED EXPLOSIVE DEVICE INCIDENTS

Oklahoma City, Oklahoma In April 1995, anti-government perpetrators detonated a 5,000-lb truck bomb in front of the Alfred P. Murrah Federal Building. The explosion killed 168 people, including 19 children in an on-site daycare facility, and injured hundreds more. The explosion also wrecked most of the nine-story facility, destroyed dozens of cars, and damaged more than 300 other buildings in the vicinity.⁷⁴

Various Locations, Malta A series of VBIED incidents occurred in several cities on the Mediterranean island in 2016 and 2017. The incidents were deemed criminal, smuggling and drug-related actions against the involved persons and a journalist. Between 2016 and 2017 alone, three people were killed by VBIEDs and at least two were injured.⁷⁵

New York, New York In May 2010, an AQAP-associated bomber loaded an SUV with explosive and incendiary devices and parked it near Times Square. An alert passerby noticed the devices, and authorities were able to avert detonation.⁷⁶

Nashville, Tennessee On December 25, 2020, a man detonated a homemade bomb packed inside a recreational vehicle (RV) next to a communications transmission facility in the downtown area. The RV was equipped with a sound system that played gunshots and provided a countdown to the explosion. The bomb killed the perpetrator, injured eight other people, damaged 40 nearby buildings, and disrupted communications in five states.⁷⁷

Liverpool, United Kingdom In November 2021, a man with unknown motives died when he detonated a self-built bomb in the taxi where he was a passenger as the vehicle pulled up in front of a maternity hospital. The taxi driver was severely injured.⁷⁸

[Return To Map](#)

73. Associated Press. "Judge sentences man to life in prison for Waukesha Christmas parade attack." NPR. November 16, 2022. <https://www.npr.org/2022/11/16/1137329530/judge-sentences-man-to-life-in-prison-for-waukesha-christmas-parade-attack>.

74. FBI. "The Oklahoma City Bombing: 20 Years Later." April 16, 2015. [fbi.gov/news/stories/the-oklahoma-city-bombing-20-years-later](https://www.fbi.gov/news/stories/the-oklahoma-city-bombing-20-years-later).

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UNINTENTIONAL VEHICLE INCIDENTS

Midlothian, Illinois An elderly man was driving through a shopping plaza parking lot in December 2021 when he began experiencing a medical emergency. The medical event caused the man's foot to depress the gas pedal, accelerating the vehicle out of his control. The vehicle struck multiple parked cars, two pedestrians standing in front of the building, and a pillar before coming to rest against the building's wall. The incident resulted in two fatalities, as well as damage to the building.⁷⁹

Tampa, Florida In March 2022, an inebriated driver sped around traffic cones and detour signals toward the Sunshine Skyway Bridge, where people were participating in a 10k race. A Florida law enforcement officer positioned her cruiser in the path of the oncoming driver ahead of the runners and race staff. The driver struck the occupied cruiser, which stopped the speeding car. Both the officer and the car's driver were hospitalized.⁸⁰

Whittier, California On November 17, 2022, a man drove onto the wrong side of the road at about 30-40 miles per hour into a group of law enforcement recruits running with road safety guides. The crash killed one person and injured more than two dozen people in the group, some critically. The crash occurred near a county fire station, allowing quicker medical response and transport of some victims than would normally be the case. The case involving the driver remains under investigation as of this writing.⁸¹

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APPENDIX B

GLOSSARY

Active Tool or Practice: A tool or practice that is operable or moves independently.

Barriers: Rectangular, standalone, or joined obstacles designed for security by preventing movement or access.

Bollards: Short, sturdy, standalone posts that can be anchored down or built-in to an area designed to block vehicle ramming.

Cloned Vehicle: Vehicle that is falsely presented as belonging to a legitimate business, law enforcement, first responder organizations, or other entities.

Crime Prevention Through Environmental Design (CPTED): Crime prevention through environmental design principles recommends improving security through “natural surveillance,” established via clear sightlines rather than surveillance technology or security personnel; perimeter barriers constructed from landscaping instead of fencing; and clear signage to aid building evacuation and first-responder access instead of equipment- and personnel-reliant communication or surveillance systems.

Deployable Tool or Practice: A tool or practice that is used for short-notice events or in response to a potential threat.

Emergency Action Plan (EAP): An incident-specific contingency plan that provides the strategy and actions that an organization or individual should take in response to a specific incident to ensure life safety and minimize the impact.

Emergency Operations Plan (EOP): An overarching emergency plan that provides the structure and processes that an organization utilizes to prepare for, respond to, and initially recover from a hazardous incident.

Hardening: Security measures taken to strengthen the security in and around a building or site to decrease the possibility of a successful attack or to make it unappealing as a target due to the added risk and effort required to commit the attack.

Improvised Tool or Practice: A tool or practice that is used to fill gaps in a defensible space.

Layered Approach: The use of multiple layers of interdependent systems to detect, deter, delay, and/or deny unauthorized access to facilities, equipment, and resources.

Passive Tool or Practice: A tool or practice that is stationary or requires effort to move.

Perimeter Protection Devices: Physical barriers that are designed and tested to prevent vehicles from intruding into a protected or restricted area. If used properly they are an effective way of protecting people and property from terrorist attacks such as vehicle ramming and VBIED, malicious activities such as vandalism and robbery, or accidental events such as storefront crash incidents.

Ramming Incident: A form of attack in which a perpetrator deliberately aims a motor vehicle at a target with the intent to inflict fatal injuries or significant property damage by striking with concussive force.

Soft Targets and Crowded Places (ST-CP): Locations that are easily accessible to large numbers of people and that have limited security or protective measures in place, making them vulnerable to attack.

GLOSSARY CONTINUED

Target Strengthening: Measures taken to decrease the probability of a successful attack or to make the target look unappealing as an option.

Vehicle-Borne Improvised Explosive Device (VBIED): A form of explosive attack characterized by using a vehicle as an improvised explosive device.

Vehicle Dynamics Assessment: An assessment that analyzes all the attack angles and maximum speeds that a hostile vehicle could take to attack a site or building.

Unintentional Incident: A form of intrusion in which the perpetrator did not have malicious intent when ramming into people or infrastructure.

APPENDIX C

ACRONYMS

A/C: Air Conditioning
ACRA: American Car Rental Association
ADS: Advanced Driver System
AED: Automated External Defibrillator
CCTV: Closed-Circuit Television
CISA: Cybersecurity and Infrastructure Security Agency
CP3: Center for Prevention Programs and Partnerships
C-IED: Counter-Improvised Explosive Device
CPG: Comprehensive Preparedness Guide
CPR: Cardiopulmonary Resuscitation
CPTED: Crime Prevention Through Environmental Design
CTEPs: CISA Tabletop Exercise Packages
DARPA: Defense Advanced Research Projects Agency
DHS: Department of Homeland Security
DSRC: Dedicated Short-Range Communication
EAP: Emergency Action Plan
EOP: Emergency Operations Plan
FAV: Fully Autonomous Vehicles
FBI: Federal Bureau of Investigation
FEMA: Federal Emergency Management Agency
GPS: Global Positioning System
HSEEP: Homeland Security Exercise and Evaluation Program
IED: Improvised Explosive Device
IVP: Infrastructure Visualization Platform
IS: Islamic State of Iraq and Syria (Islamic State, for shorthand)
ITS: Intelligent Transportation System
JCAT: Joint Counterterrorism Assessment Team
LTE: Long-Term Evolution
OBP: Office for Bombing Prevention
PSA: Protective Security Advisor
RV: Recreational Vehicle
SPR: Stakeholder Preparedness Review
ST-CP: Soft Targets and Crowded Places
SUV: Sport Utility Vehicle
TRALA: Truck Renting and Leasing Association
TSA: Transportation Security Administration
USB: Universal Serial Bus
VBIED: Vehicle-Borne Improvised Explosive Device
WiMax: Worldwide Interoperability for Microwave Access

APPENDIX D

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