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"Smashing Into Crowds" -- An Analysis of Vehicle Ramming Attacks

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MINETA TRANSPORTATION INSTITUTE

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REPORT SP 11-19

“SMASHING INTO CROWDS” — AN ANALYSIS OF VEHICLE RAMMING ATTACKS

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November 2019

A publication of
Mineta Transportation Institute
Created by Congress in 1991

College of Business
San José State University
San José, CA 95192-0219

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. SP 11-19	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle "Smashing Into Crowds" -- An Analysis of Vehicle Ramming Attacks		5. Report Date November 2019 6. Performing Organization Code
7. Authors Brian Michael Jenkins, https://orcid.org/0000-0001-6583-7790 Bruce R. Butterworth, https://orcid.org/0000-0002-5105-9788		8. Performing Organization Report CA-MTI-1775
9. Performing Organization Name and Address Mineta Transportation Institute College of Business San José State University San José, CA 95192-0219		10. Work Unit No. 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Transportation Security Administration Operations Support 701 S 12th Street Arlington, VA 20598		13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code
15. Supplemental Notes		

16. Abstract

Vehicle ramming attacks are not new. But since 2010 Jihadists have urged their use. Is this the wave of the future, or a terrorist fad?

To answer this and other questions the authors expanded and updated the database used in their May 2018 MTI Security Perspective entitled An Analysis of Vehicle Ramming as a Terrorist Threat to include 184 attacks since January 1, 1970. They also reviewed literature and examined some cases in detail.

This MTI Security perspective indicates that while not new, vehicle rammings are more frequent and lethal since 2014, although the number of attacks seems to be dropping in 2019. Still it is too early to know if this is because of government countermeasures or because it is a fad that has come and gone. They also found that: (a) the majority of attacks occur in developed countries like the US and Europe; (b) though not more lethal than some other tactics they can be easily carried out by those who cannot get bombs or guns in a target-rich environment that is difficult to protect; (c) while Jihadists (responsible for only 19% of the attacks) have exhorted their use since 2010, it isn't clear these calls have been successful -- instead the pattern of attacks suggest a kind of wider contagion; (d) attackers plowing vehicles into public gatherings and pedestrianized streets are the most lethal, particularly the attacks are planned and the drivers rent or steal large trucks or vans driven at speed; and finally, (e) government authorities cannot prevent these attacks but can and are doing things to prevent them and mitigate fatalities when they occur.

17. Key Words Safety and security, terrorism, threats, weapons	18. Distribution Statement No restrictions. This document is available to the public through The National Technical Information Service, Springfield, VA 22161		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 54	22. Price

Form DOT F 1700.7 (8-72)

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ACKNOWLEDGMENTS

The authors thank Editing Press, for editorial services, as well as MTI staff, including Executive Director Karen Philbrick, PhD; Deputy Executive Director Hilary Nixon, PhD; Graphic Designer Alverina Eka Weinardy; and Executive Administrative Assistant Jill Carter.

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EXECUTIVE SUMMARY

- Vehicle ramming attacks are not a new tactic, but the volume and lethality of vehicle ramming attacks has increased over the long run, although based upon the first nine months, it appears that the number of attacks will significantly decline in 2019.

- MTI's latest tally shows 184 vehicle ramming attacks since 1963; 128 (70% of the these) have occurred since January 1, 2014.

- Unlike other forms of terrorist attack, most of which occur in conflict zones in the developing world, most vehicle ramming attacks occur in developed countries—Europe and the United States account for more than half of the recent attacks.

- Mentally unstable individuals—people who did not get the help and intervention they needed in time—account for 91 of the 184 attacks (49%) and also account for 209 (43%) of the 481 fatalities, the largest share of any attacker group. Attackers motivated by Jihadist sentiments or ideology account for only 19 (10%) of the attacks and 144 (30%) of the fatalities.

- Not counting the drivers, vehicle rammings average 2.6 fatalities per attack.

- Vehicle ramming attacks are not the most lethal terrorist tactic, but for those who cannot get guns or bombs, vehicles are a readily available "weapon" and easily accessible targets are just around the corner.

- Terrorists did not invent the tactic of ramming vehicles into crowds of people. Like kidnappings and airline hijackings, they adopted into their repertoire a tactic that had already appeared in earlier incidents.

- None of the terrorist groups that appeared in the late 1960s and early 1970s utilized the tactic. They preferred bombs and guns—legitimate weapons of revolutions and war.

- Ramming attacks did not become a terrorist tactic until the 1990s when Palestinians started carrying out vehicular assaults in Israel, and did not become a major feature of the Palestinian terrorist campaign until a decade later.

- Both al Qaeda and ISIS have urged their followers abroad to carry out car ramming attacks beginning in 2010. The initial exhortations produced no discernible response.

- A cluster of attacks appears to follow the November 2016 issue of the online ISIS magazine *Rumiyah*, which urged car ramming attacks, but a spectacular attack in Nice, France, which killed 86 persons and preceded the exhortation in *Rumiyah* by four months, may have inspired both the author of the article and other attackers.

- More important, the data show a contagion effect that reaches beyond political extremism. It is not an ideology, exhortation, or lack of violent alternatives that unite

the perpetrators of vehicle ramming attacks—it is the tactic. One event inspires another. Attacks occur in clusters.

- The data from 1981 to the end of September 2019 show a gradually growing volume of attacks with a sharp increase after 2013 followed by a decline in 2019. Lethality also increases very gradually, then declines, owing to the greater volume of low-level incidents.

- A majority of the attacks (54%) occur in the more developed countries (minus Israel); the developing world accounts for 23% of the attacks; 22% of the attacks take place in Israel and the West Bank.

- However, the developing world accounts for 49% of the fatalities compared to 45% in the developed world.

- As for individual countries, Israel and the Palestinian Territories lead with 41 attacks, followed by the United States with 39 attacks, China with 28, France with 14, and the United Kingdom with 10.

- In countries with more than 10 attacks, those in China have been the most lethal, followed by France, United Kingdom, Israel and the Palestinian Territories, and the United States. (This may be skewed by incomplete reporting of low-level incidents in China.)

- Of the four major attacker categories, mentally unstable individuals account for 91 (49%) of the attacks and 43% of the fatalities; Palestinian attackers account for 22% of the attacks but just 6% of the fatalities; jihadists account for 10% of the attacks but 30% of the fatalities; finally, right-wing extremists account for 5% of the attacks and 4% of the fatalities.

- Attacks by jihadists and mentally unstable attackers have seen the sharpest increase in recent years.

- Confirmed and possible suicide attackers are the most lethal—they account for 17% of the attacks but 44% of the fatalities.

- Incidents with the highest number of fatalities per attack occur when attackers are able to plow into public gatherings; people walking on partially pedestrianized streets that allow some vehicle traffic come next, followed by people gathered at bus stops or near train stations.

- Most attackers (71%) use their own or a family vehicle; in 9% of the cases, the vehicle is stolen, and in 5% of the cases the vehicle is rented.

- Attacks involving rental vehicles, however, are the most lethal, accounting for 29% of the total fatalities. This reflects that fact that the attack is the result of prior planning, not spontaneous, and that renters are able to acquire larger vehicles,

which can be more lethal.

- Given that urban areas contain hundreds of thousands to millions of vehicles and millions of pedestrians, prevention of vehicle ramming attacks is not a realistic security goal.

- More realistic are mitigation measures that focus on improving the protection of the most attractive and lucrative targets of vehicle ramming attacks—public gatherings, street markets, and pedestrianized or partially-pedestrianized streets. This can be achieved with both temporary and permanent barriers.

- Recommended security efforts also include increasing scrutiny of vehicle renters, especially those renting large vans or trucks.

I. INTRODUCTION

On April 3, 2019, police in Maryland arrested a man for plotting to drive a stolen rental van into crowds of people at National Harbor, a popular tourist site along the Potomac River. A convert to Islam, he claimed to have been inspired by the Islamic State of Iraq and Syria (ISIS). The defendant had stolen the rental van several days before in Virginia and initially contemplated driving into passengers at Dulles International Airport, but found the crowds there were too sparse for his purpose. He then changed the target to National Harbor, just under 10 miles from the Capitol in Washington, DC. The incident was one of was one of nearly 13 to occur in the first three quarters of 2019 across the world

Vehicle ramming attacks or vehicular assaults, as they are sometimes called, continue to be a popular terrorist tactic, although the motivation of the attacker is not clear in all cases and some appear to be the result of unstable or disturbed minds. The Mineta Transportation Institute issued an earlier report on the tactic in May 2018.[1] This report expands and updates that analysis and more than doubles the number of incidents included. We were also able to collect more information about the old and added events, allowing us to refine the research and state findings with greater confidence.

There is no need to examine both reports. Where relevant, we point out where the new analysis has altered some of the observations made in the earlier report.

This report examines 184 car ramming attacks from a number of perspectives, including overall trends, lethality, geographic location, perpetrators, tactical innovations, and venues. That enables us to suggest some possible countermeasures as well evaluate some of the proposed countermeasures.

II. WHY TERRORIST TACTICS HAVE EVOLVED TO MORE PRIMITIVE TACTICS

In terms of trajectory and total numbers, the popularity of this tactic resembles the rise of kidnappings of diplomats following the abduction by urban guerrillas in Brazil of the American ambassador in Rio fifty years ago in September 1969. By the beginning of the 1980s, more than 150 diplomats had been the targets of terrorist kidnappings. Airline hijackings also saw a dramatic increase in the later 1960s and early 1970s before increased security measures, international agreements, and pressure on the terrorist groups reversed the trend.

Terrorist tactics have evolved incrementally over the past half-century. The basic terrorist repertoire—bombings, armed assaults, assassinations, hostage-taking—remains close to what it was in the early 1970s. Over time, heightened security measures have reduced the frequency of certain tactics and attacks on certain target sets: airline hijackings have become a rare event; terrorists no longer storm embassies; fewer diplomats are kidnapped.

Terrorists have always preferred soft targets where they do not have to plan to and then overcome security measures. Since unprotected targets are virtually unlimited, there is little pressure for terrorist innovation in tactics or weapons.

The terrorist arsenal has also remained stable for a half-century. Improvised explosives, assault rifles, and ordinary firearms are used in most attacks and account for most casualties. Recent knife and axe attacks and vehicular assaults reflect a trend toward more primitive weapons and tactics. This, in turn, reflects recent changes in terrorist strategies and recruiting.

Terrorists escalated their violence by orders of magnitude between the 1970s and 2001, the year of the 9/11 attacks—from tens to hundreds to thousands. Terrorist tactics rely on shock value to attract attention. Staying in the headlines requires escalating violence or by bringing it closer to ordinary living—pedestrians walking on streets or sitting at restaurants or pubs—in other words, by making it appear that no one anywhere is safe.

The emergence of groups inspired by religion-based ideologies contributed to the escalation of violence. The substitution of God's will for political constituency eroded self-imposed constraints, such as killing large numbers of innocent civilians, including children. Religious fanatics count only on heavenly approval for their actions. Condemnation by those regarded as unbelievers or infidels matters little, and undiluted commitment guarantees paradise. Among religiously inspired terrorists, suicide attacks became common.

Extrapolating from the 9/11 attacks led authorities to worry about future events that could produce tens or hundreds of thousands of casualties. Attacks of this scale could be achieved only with weapons of mass destruction, which many presumed would be the next terrorist step. But obtaining such weapons would require centralized enterprises with considerable resources and capabilities and involve larger groups of people, which increases the chance of detection.

Terrorism has not followed the anticipated post-9/11 trajectory. Following the 9/11 attacks, al Qaeda was put under enormous pressure, and many of its leaders and key operatives were killed or captured; further, its communications and control were disrupted, degrading its operational capabilities. On the run or hiding out, al Qaeda's central leadership was obliged to rely on the local initiative of its members to continue its global jihad. In this more-hostile operating environment, carrying out strategic strikes on the scale of 9/11 or even larger seemed less likely.

Until about 2006, al Qaeda alumni and allies were still able to carry out terrorist operations that were one or two orders of magnitude less than the 9/11 attacks but still spectacular—attacks in Tunisia, Indonesia, Kenya, Saudi Arabia, Morocco, Egypt, Turkey, and Jordan, in addition to major attacks in Spain and the United Kingdom. These attacks persuaded the countries affected to more vigorously suppress the local groups that threatened them directly and to cooperate more closely with other nations facing similar threats. Gradually the level of violence subsided, although lower-level attacks continued.

However, the political turmoil that spread across North Africa and the Middle East in 2011 presented the Jihadists with new opportunities, which al Qaeda was quick to exploit. Its comeback, however, was disrupted by a deadly internal schism that saw the emergence of a rival Jihadist enterprise in Syria and Iraq—the Islamic State of Iraq and (greater) Syria, or ISIS. ISIS took advantage of the tumult caused by the civil war in Syria and continuing antipathy between the Sunnis and Shias in Iraq to sweep across the two countries and establish the Islamic State, which attracted expressions of support and pledges of loyalty from groups across the region.

In contrast to al Qaeda's priority of attacking the "far enemy," ISIS remained focused on the local struggle—building the Islamic State and defending its territory. But like al Qaeda, ISIS used the Internet and, even more effectively, social media to attract recruits and inspire action abroad.

Instead of the vertical escalation anticipated immediately after 9/11, the Jihadists escalated laterally to remotely field a global army. Recruiting into the ranks of the post-9/11 Jihadists differed significantly from terrorist recruiting in the 1970s. The early cohorts of volunteers were vetted before being taken into tiny clandestine organizations, which had to survive underground in a hostile environment. The danger of infiltrators or of unreliable recruits posed operational and organizational risks. The groups remained small. In contrast, Jihadist recruiting relied on exhortation rather than traditional recruiting.

Volunteer Jihadists were urged via the Internet and social media to act on their own initiative. If they could make it to an al Qaeda training camp or, later, to the Islamic State, they would be welcome. Tens of thousands flocked to the Islamic State. It is unlikely that all the arrivals were reliable, but this was not a serious problem where ISIS maintained absolute control—recruits could not easily betray the organization, and if judged unreliable, they could be dispatched to suicide missions.

Recruiting for operations abroad required no investment on the part of ISIS. Their online magazines and communicators on social media could reach a broad audience, providing

potential recruits with inspiration and instructions. If they carried out an attack, their actions would bring applause and recognition—the remote conferral of membership and status as warriors. It was low-yield ore, producing a large but mostly virtual army and occasional low-level actions.

The change in recruiting methods produced changes in the local terrorist population and also affected tactics. The Internet attracted individuals—it did not create local groups. Terrorist campaigns were replaced by one-off attacks; there was no institutional learning, no improvement in operational skills over time. Instead, jihadists remained mostly unconnected individuals operating alone with limited resources. When they did reach out to join others, they risked being taken in by police undercover operations. Isolated jihadists could not sustain terrorist campaigns or inspire sufficient numbers to create a high volume of violence.

The use of vehicles as weapons is an ideal tactic for today's circumstances. Vehicles are a readily available "weapon." Limited skill is required, and the ability to drive is widespread. Little preparation is required for an attack. Cities filled with people and vehicles provide ample targets which cannot easily be protected, and high body counts are potentially achievable. It is not surprising, then, that the number of car-ramming attacks has increased.

III. TERRORISTS DID NOT INVENT THE TACTIC

Terrorists did not invent the tactic of ramming vehicles into crowds of people. Like kidnappings and airline hijackings, they adopted into their repertoire a tactic that had already appeared in earlier incidents. The first incident in our database occurred in 1964 and involved an angry bus driver who drove his vehicle through the streets of Taipei, running down four people, three of whom died, before stabbing himself in an attempted suicide. In 1973, a mentally-unstable 21-year-old woman living in Czechoslovakia decided to take revenge for the hatred she felt from society and her family. She rammed a truck into people waiting for a tram in Prague, killing 8 and injuring 12. She was later executed. Most of the early incidents were carried out by persons who can be described as mentally unstable—people who did not get the help and intervention they needed in time.

None of the terrorist groups that appeared in the late 1960s and early 1970s utilized the tactic. They preferred bombs and guns--legitimate weapons of revolutions and war. Running down pedestrians at random would have tarnished their image and alienated supporters. Adopting vehicle ramming as a tactic was a response to operational needs, but it also required a change in mindset. More recent generations of terrorists escalated their violence, which almost always meant killing indiscriminately. Random murder—generally associated with mentally unstable perpetrators—is a more recent terrorist adoption.

Ramming attacks did not become a terrorist tactic until the 1990s when Palestinians started carrying out vehicular assaults in Israel. Many of the attacks targeted off-duty soldiers waiting at bus stops—a ubiquitous sight in Israel—but some of the attacks were directed against both soldiers and groups of civilians.

The adoption of the tactic by Palestinians was initially tentative. The drivers were not known to be members of any of the Palestinian terrorist groups and may have been acting on their own volition—no group publicly urged car ramming as a tactic. Vehicle ramming attacks were not a feature of the First Intifada, which began in 1987, ironically in reaction to an Israeli truck driver losing control of his vehicle and colliding head-on into an automobile near a large Palestinian refugee camp, killing four. Palestinians began rioting in response to what they saw as a deliberate attack. The violence associated with uprising subsided in 1991 and ended in 1993.

After one early incident in 1991, in which a Palestinian attempted to ram Israeli soldiers waiting at a hitch-hiking post, the next incident in Israel occurred years later in 1996 when a car crashed into passengers at a bus stop in Jerusalem, killing three and injuring 11.[2]

The next vehicle ramming attack in Israel did not occur until 1999 when a Palestinian driver steered his car into a crowd at a bus stop, sped off, and returned minutes later and attempted to run over the victims of the first attack. Another attack occurred in 2001 when a Palestinian bus driver plowed his vehicle into a crowded bus stop, killing eight, including seven soldiers, and injuring 17 others.

In this case, the driver’s motives remain unclear. He had passed Israeli security checks to obtain his permit to drive a bus in Israel, and was not known to be a militant or to have

suspicious connections. His family said he did not belong to any group. He had begun seeing a psychiatrist for severe depression and was taking medication. The incident occurred just months after the beginning of the Second Intifada, and family members indicated that he closely watched the events on television where he lived in Gaza. Whether he had been secretly recruited, decided on his own to act, or simply snapped is not known.

HAMAS claimed responsibility, but Yasir Arafat, the head of the Palestinian Authority, said the incident was an accident, not a deliberate attack, indicating that he did not want the Palestinian Liberation Organization (PLO) to be associated with such an act.

Car ramming did not become a major feature of the Palestinian terrorist campaign until a decade later. The 2001 bus attack was the only vehicle ramming attack to occur during the Palestinian uprising known as the Second Intifada from 2000 to 2005, during which there were hundreds of bombings, armed assaults, and rocket and mortar attacks. Occasional vehicle ramming attacks occurred during subsequent years, especially in the summer of 2008, but the sharp increase in Palestinian vehicle attacks did not begin until after 2014. Still, HAMAS and the Palestinian Islamic Jihad were the only Palestinian groups to call for such attacks. By 2016, vehicle ramming attacks had evolved from a statistically rare event to reportedly become the second most common form of attack in Israel and the second deadliest form of attack carried out by Palestinians, behind only stabbing.[3]

The increasing difficulty of smuggling explosives into the West Bank after the construction of the West Bank Barrier built in response to the Second Intifada and increased border barriers and controls between Gaza and Egypt is offered as at least a partial explanation for the subsequent increase in car rammings by Palestinians. Car rammings increased as preferred modes of attack became more difficult. Palestinians may also have found inspiration in exhortations from global Jihadist groups like al Qaeda and ISIS.

IV. THE JIHADIST "MOWING MACHINE"

Both al Qaeda and ISIS have urged their followers abroad to carry out terrorist attacks, specifically car ramming attacks. In a 2010 issue, *Inspire,* the online magazine created by al Qaeda in the Arabian Peninsula (AQAP), suggested using a vehicle as a "mowing machine," not to mow the grass, but to mow down the enemies of Allah in a vehicle ramming attack.[4]

The article provided some practical advice on choosing a vehicle (a pick-up truck preferably with four-wheel drive), choosing an appropriate place (pedestrian-only locations are recommended), and it mentioned the need to gain speed and aim for the crowd.

Yahya Ibrahim, *Inspire*'s chief editor and the author of the article, also instructed readers how they might modify the vehicle to make it a more effective killing machine by mounting steel blades to the grill, thereby ensuring that the truck would slice through its victims' torsos rather than merely hitting them in their lower extremities. This added elaboration seems needless and increases risk since it requires extra material and logistics. None of the attackers made the modifications.

However, the gory imagery served al Qaeda's propaganda purposes, guaranteeing media attention and sending shivers down the spines of those in the West who would read about it in press accounts. The descriptive language is also typical of terrorist porn, intended to excite its readers with visions of cleaved corpses flying through the air. For many would-be jihadists, action means vicarious participation in vivid verbal and visual fantasies.

ISIS has repeatedly called for vehicle ramming attacks. In 2014, its spokesman, Abu Mohammad al-Adnani, instructed followers abroad to attack American and French disbelievers and their allies using bombs and guns, and if these were not available, "smash his head with a rock, or slaughter him with a knife, or run him over with your car." A French-language video also produced by ISIS in 2014 urged followers to "kill them and spit in their faces and run them over with your cars."

In a 2016 issue of its online magazine, *Rumiyah,* ISIS outlined how followers outside the Middle East could kill the enemies of Islam. In grisly language similar to that used by al Qaeda, ISIS describes how the "Crusaders" will be reminded of the painful reality by "vehicles that unexpectedly mount their busy sidewalks, smashing into crowds, crushing bones, and severing limbs".[5] Carrying out a vehicle ramming is an appropriate way of "announcing one's allegiance" to the organization. The Islamic State's leader and its websites have repeated the call for ramming attacks.

In his August 2018 message, ISIS leader Abu Bakr al-Baghdadi urged followers abroad to carry out attacks "that will tear out their hearts and make them lose their minds, for a piercing bullet, or a stab deep in the intestines, or the detonation of an explosive device in your lands is akin to a thousand operations here with us [in Iraq and Syria], *and don't neglect the ramming attacks on the roads*."[6]

On August 8, 2019, a communication from ISIS appeared on an encrypted messaging platform urging believers abroad to attack targets in the United States, Russia, and Europe. The image depicts a masked driver reflected in a rearview mirror. Looking ahead through the windshield, one can see a busy intersection with a yellow taxi, suggesting a vehicle attack in New York City. On the 18th anniversary of the 9/11 attacks, Al Qaeda leader Ayman al-Zawahiri issued a video urging renewed commitment and action, using Israel as a motivating factor, but he did not focus on or highlight vehicle rammings as had been done previously.[7]

The initial exhortations by al Qaeda in 2010 and ISIS in 2014 produced little immediate response. In May 2015, an Emirati ran over a U.S. jogger in the United Arab Emirates. The jogger survived. The driver had previously traveled to Turkey in an unsuccessful attempt to join al Qaeda’s affiliate in Syria and was also reported to be plotting other terrorist attacks when he attempted to kill the American jogger. In January 2016, a French Jihadist drove his vehicle into French soldiers guarding a mosque in Valence, France, injuring two.

On July 14, 2016, however, a Jihadist inspired by ISIS drove a truck into a crowd of people who had gathered on the Nice waterfront to watch the fireworks celebrating Bastille Day. He killed 86 persons and injured several hundred. This remains the deadliest vehicle ramming attack and a continuing source of inspiration. Our database identifies 15 more Jihadist-inspired vehicle-ramming attacks since the 2016 attack in Nice.

It is difficult to discern any close correlation between the Jihadist publications and subsequent Jihadist attacks. In the MTI database, there is a 55-month gap between the 2010 article and the first vehicle assault we can clearly label as “Jihadist.” Further, the November 2016 call for vehicle ramming attacks in ISIS’ *Rumiyah* appeared months after the Bastille Day attack, suggesting that ISIS was just as much inspired by events as it was the source of the inspiration. Overall, we can merely say that there was an accumulation of exhortations and eventually an increase in attacks.

Figure 1 illustrates the lack of a clear correlation between Jihadist attacks since 2010 and 2019 and the exhortations we have described.

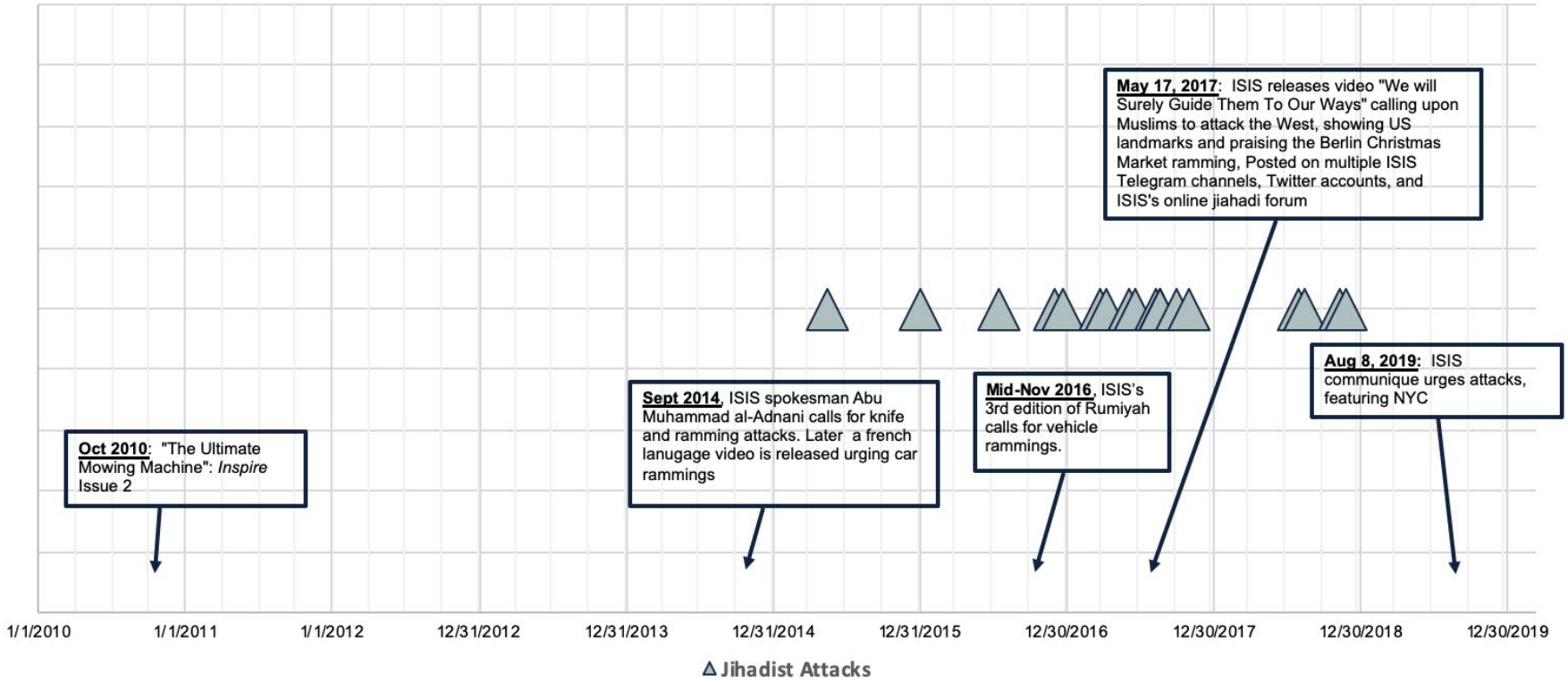

Figure 1. 2010 through Sept 2019: Jihadist Exhortations and Attacks

The initial exhortations produced no discernible response. A cluster of attacks appears to follow the November 2016 issue of Rumiyah, but the spectacular attack in Nice, France, which occurred in July, may have had an inspirational effect. Similarly, the May 2017 video that ISIS posted on multiple Telegram channels, twitter accounts, and their Jihadist forum may have inspired the six Jihadist vehicle ramming attacks in France, the United Kingdom, and Spain that occurred in the following three months, but again the attacks themselves may have inspired imitation.

Repeating the same messages over and over again, hoping to ultimately affect their audience’s behavior, is often a feature of advertising and political campaigns. Given the ability of al Qaeda and especially ISIS to reach a large audience via the Internet and social media; the ease, especially in the United States, of acquiring a vehicle; and the minimal planning necessary to use it in an assault, the small number of Jihadist vehicle ramming attacks suggests that the Jihadist campaign has produced only meager results. In the more than eight years since al Qaeda published its first article urging followers to carry out vehicle ramming attacks, there have been only **two** such vehicle ramming attacks in the United States that can be clearly labeled Jihadist. Jihadists in Europe have carried out 11 vehicle ramming attacks. In this sense, one can argue that thus far this Jihadist campaign is anything but a public relations success. The Jihadists’ exhortations targeting the 3 to 4 million Muslims residing in the United States have produced two clearly confirmed Jihadist vehicle rammings since 2006. As a marketing campaign, it would be judged so far to be a failure.

At the same time, two-thirds (18) of the 27 vehicle ramming cases in the United States since those exhortations have been carried out by mentally disturbed individuals who had no known connections with al Qaeda or ISIS. However, in the public’s mind, they are blended with the Jihadist attacks and add to the general level of fear. The Jihadist propaganda machine was therefore able to brand the tactic and benefit from its occurrence regardless of who was responsible.

Since the fall of the Islamic State, at least as far as controlling territory, ISIS propaganda activities have been greatly reduced. Although it remains active on the internet, for now, ISIS seems focused on continuing its insurgency in Syria and Iraq. Terrorist activities outside of countries where ISIS has established active fronts (Syria, Iraq, Libya, Afghanistan, and several countries in Africa) also declined in 2019. No vehicle-ramming attacks inspired by ISIS have occurred since November 2018.

V. A CONTAGION EFFECT THAT TRANSCENDS POLITICAL EXTREMISM

Exhortation by terrorist organizations and operational necessity, by themselves, may not sufficiently explain the spike in vehicle ramming attacks. In a recent article in the *British Journal of Criminology,* Vincent Miller and Keith J. Hayward ask, "Why, given the mass availability of automobiles for many decades around the world, have these motorized crimes suddenly been adopted by everyone from committed Islamic State-affiliated jihadists to 'lone-wolf' Palestinians and other Muslims with no previous links to organized terrorist groups, to anti-Muslim extremists, to American right-wing Christians, to unbalanced members of the public at large?"[8]

The authors argue that the release date of the online terrorist exhortations does not correspond to the pattern of attacks. They point out that more than four years passed between the publication in 2010 of "the ultimate rowing machine" article and the rise of vehicle ramming attacks in Western cities. (The authors suggest that the 2010 article may have been inspired by a 2006 vehicle ramming attack. The 2006 attack on the campus of the University of North Carolina in Chapel Hill, which injured 9 people, was carried out by an individual who professed anger about the treatment of Muslims around the world). *All* of the eleven vehicle ramming attacks in Europe and the United States between the article in *Inspire* and the first Jihadist attacks were carried out by individuals who can be described as mentally unstable.

Miller and Hayward are also critical of what they call the "security hypothesis," pointing out that "preventative measures against terrorism have been in position for decades" and therefore cannot explain the recent shift to softer targets. This observation is not entirely true, and is therefore a weaker argument. Counter-terrorist measures around train stations and the public areas of airports have been increased, with additional police and military patrols, for example and bollards in cases, particularly in Israel.

More important, security measures include not only target hardening, but efforts to make the acquisition of explosives for bombs—the traditionally-favored weapon of terrorists—more difficult. Improved intelligence and broadened police powers have also made the formation of conspiracies more difficult, forcing groups like al Qaeda and ISIS to rely on remotely-inspired lone operators who have limited resources. We would suggest that changes in recruiting methods also contribute to the increased use of more accessible "weapons" and the adoption of more primitive tactics.

Nonetheless, we agree with Miller and Hayward in their conclusion that the data also show a contagion effect that reaches beyond political extremism. It is not ideology, exhortation, or a lack of violent alternatives that unite the perpetrators of vehicle ramming attacks—it is the tactic itself. One event inspires another, creating a contagion effect propelled by modern communications technologies, particularly social media.

For example, some of the attacks carried by mentally unstable individuals have been inspired by previous attacks, primarily through the internet. Alek Minassian, who rented a van and ran over and killed 10 and injured 15 on April 23, 2018 in Toronto, Canada, was

a member of the “Incel” (Involuntary Celibate) movement. After his arrest, he said he had been in contact with Eliot Rogers, also an “Incel”.

According to reviews of the official 2015 police report released in 2015, on May 23, 2014, in Isla Visa, California, Rogers stabbed and killed two male roommates. He then bought a latte, sat in his black BMW coup, and calmly uploaded his final video called “Retribution,” promising a night of revenge against the females who had denied him the pleasures of a normal sexual life. At around 9:15 pm, he drove to the Alpha Phi sorority house and shot three women (two of whom were killed). He drove off and shot several people from his car and rammed into a number of others. He finally slammed into a parked car. Police arriving at the scene found that he had killed himself by a gunshot to the head. In just eight minutes he had killed 6 and injured 14. [9]

Minassian said that he hoped his act would inspire others who were “too cowardly to act on their anger.” He warned, “I know of several other guys over the internet who feel the same way.”[10]

The contagion effect described by Miller and Hayward goes beyond mere imitative behavior. It represents a more complex phenomenon in which diverse actors animated by a variety of individual circumstances and group causes observe and incorporate vehicle ramming attacks as a mode of acting out. The connectivity is not the motive, but the performance is.

Clearly, as we shall see below, the world has witnessed a dramatic increase in vehicle ramming attacks since 2014, and especially in the period 2017 and 2018. This does suggest the kind of diffusion of terrorist tactics that was seen in airline hijackings, kidnappings of diplomats, and takeovers of embassies in the 1970s.

One might also look for a contagion effect in the distribution of these attacks during this recent period. Although many of the attacks occur with less than a month’s separation, and there are single days in which two attacks took place around the world, it is in the heavier volume of events in 2017 and 2018 that more clearly discernible clusters are found. For example, in 2017, of the 36 attacks, more than half took place in three clusters: 6 in only 13 days, 6 in 25 days, and 5 in 20 days. More striking still, in 2018, 26 of the 35 attacks (nearly 75%) took place in five clusters: 5 each in periods of 17, 19, 20 and 24 days, and 6 in 28 days. The “clustering” of attacks since the surge began in 2014 can be seen in Figure 2A; the display of the fatalities caused, are more sporadic showing varying degree of attacker skill or “luck”, is displayed in Figure 2B.

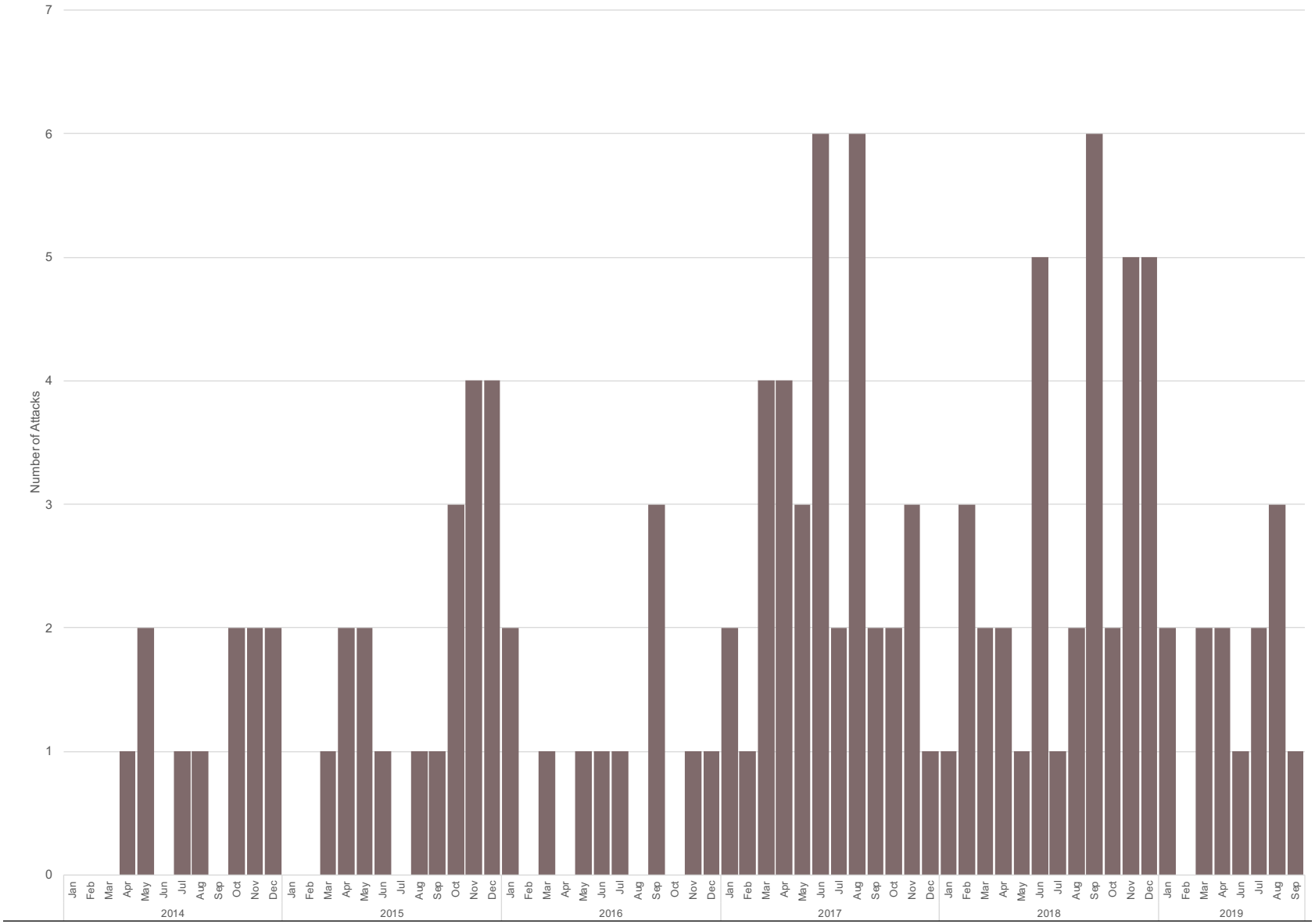

Figure 2A. All Attacks: 2014 through September 2019

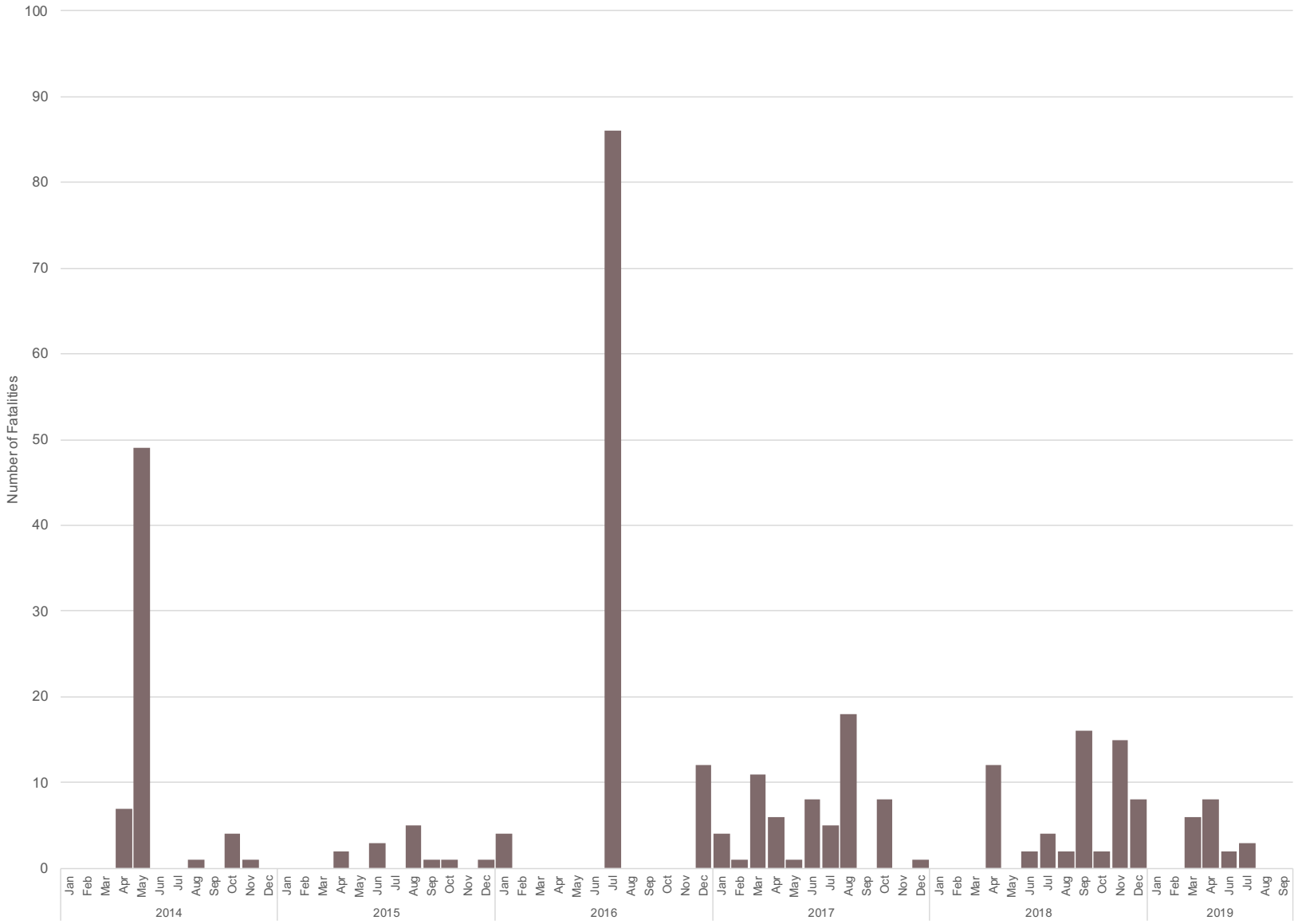

Figure 2B. All Fatalities: 2014 through September 2019

The ease of vehicle ramming allows spontaneity, which in turn may manifest itself in the observed contagion effect. However, Israeli officials who have examined such attacks in Israel would question the perception that vehicle ramming attacks reflect spur-of-the-moment decisions. Tracking back through the Internet activity of the attackers suggests that the idea of a vehicle ramming attack entered their minds well before the attack itself. The attack itself may reflect a sudden impulse or opportunity, but does not reflect when the attacker started to think about it. This offers an opportunity for dissuasion or deflection. What we do not know is how many individuals may have thought about such scenarios before abandoning the idea.

This is the way terrorist tactics spread. A spectacular terrorist event will prompt many terrorist groups and individuals to contemplate whether such a tactic or target would work for them. Operational constraints (one individual recruited in an unsuccessful plot to carry out a vehicle ramming attack did not know how to drive), individuals assessing the risk as too high, or considerations of personal morality may cause many to discard the idea. The response to exhortations and tactical innovations is low yield. But if there are enough imitators, the innovation becomes a wave.

Similar to previous waves of airline hijackings and the current phenomenon of mass shootings, vehicle ramming attacks empower marginalized individuals, at least for a brief moment. The tactic may subside, as have other tactical fads, only to be replaced by some other form of accessible violence.

VI. BY THE NUMBERS

Vehicle rammings occur almost every day. Most of these are not vehicular assaults by terrorists, but rather rammings by drivers overcome by road rage, persons in the middle of domestic quarrels who run over their partner in the driveway, and individuals attempting to escape police in pursuit.

Our focus was on attacks directed against public targets, that is, those directed against pedestrians on public streets or adjacent public buildings, including tourist sites, hospitals, and restaurants; public gatherings, including street markets, spectator events, celebrations, and demonstrations; and surface transportation hubs, including bus stops and train or bus stations. We also included attacks against police or other security personnel guarding public places. We were especially interested in attacks by persons who expressed some kind of political motive, but we also included attacks by persons judged to be mentally disturbed, recognizing that the line between the two types of attackers is sometimes thin.

We excluded attacks in war zones, where police or military personnel manning checkpoints are often targets. We excluded vehicular attacks in which the primary purpose was to deliver an explosive device. We also excluded ramming attacks on government buildings such as embassies or military bases.

We also chose to exclude attacks against military forces in their barracks or while not actively protecting the public, or manning checkpoints—as they do frequently in the West Bank. We have also excluded attacks on military forces in the UK, France, and Canada, for example. However, we have included attacks against military personnel when they are at bus stops or train stations, or guarding any public target. These are judgment calls that we needed to make.[11]

Also excluded were accidents—which, by definition, are not attacks—as well as ramming attacks that targeted a particular individual, such as altercations between motorists. And finally, we excluded rammings connected with escaping criminals and car chases. Excluding anger in and of itself is not possible.

As with all databases, in many cases, the decision to include or exclude a specific incident unavoidably requires some judgment. Readers might disagree here or there, but we do not believe that occasional definitional differences are likely to have more than a marginal effect on the basic observations.

The database used in this analysis has been created by the authors and is not part of the terrorist databases held by either the Mineta Transportation Institute or the RAND Corporation. Using the Global Terrorism Database maintained by START at the University of Maryland, some material available from the RAND Corporation, and a few incidents contained in MTI's own database, along with our own searches, we identified **184** vehicle ramming events to be analyzed. Although this more than doubled the number of incidents examined in the earlier MTI report, we cannot claim that this figure represents the universe of vehicle ramming attacks—incidents with no or few casualties that occurred years ago in areas with little media coverage may be lost in the mist of time. We did not include those

incidents where we could not ascertain whether the attack met our criteria. For example, the Israel Ministry of Foreign Affairs reported in September 2019 that there had been 765 vehicle ramming attacks in the previous 48 months, resulting in 10 fatalities.[12] During this same period, we have recorded 24 vehicle ramming attacks in Israel and the Palestinian Territories, accounting for 8 fatalities.

We collected the available information about the **184** attacks and sorted it according to date, country, nature of target, perpetrator, casualties, and other attributes. In doing so, we relied primarily on media accounts from generally reliable sources. We did not use any classified information.

Counting events in Israel and the Palestinian Territories poses a special challenge to analysis. In the ten-year period between 2009 and 2018, the Israeli Foreign Ministry recorded 322 people in Israel killed by terrorists—an average of 32 per year.[13] Approximately ten times that number die in road accidents in Israel each year, although the totals show road deaths have recently declined. Vehicle rammings are a tiny subset of terrorist-caused fatalities. MTI's database records 30 deaths resulting from car ramming attacks in Israel and the West Bank since 1970. We are uncertain if this is complete.

Looking at available sources of information, no two databases agree. News media accounts are incomplete—many incidents are not reported in the international press. Local accounts are not readily available and sometimes reflect biases. Some see almost every traffic accident involving an Arab driver and Jewish victims as a deliberate attack. Other sources report car ramming attacks by Israeli settlers on Palestinians, but whether these are deliberate attacks or hit and run accidents is hard to ascertain, although we acknowledge that such attacks may occur. We intend no political statement by the inclusion or omission of any event.

To produce a comprehensive report on vehicle ramming attacks in Israel and the Palestinian Territories would require a major research effort by itself and its findings would be contentious. That is beyond our resources and not the purpose of this broader report.

In some cases, we did not have accurate data on the vehicle type or weight or information about its speed, which would be useful. While there is still work to be done and errors are always possible, we are confident that we have a reasonably accurate representation of the selected events.

LONG-TERM TRENDS: ATTACKS AND LETHALITY OVER THE YEARS

Figure 3 shows the volume of attacks and their lethality calculated from 1981 through the end of the third quarter of 2019, illustrating the sharp increase in the volume of attacks after 2013. The number of attacks in the updated data set increased from **78** to **184**, and the total fatalities increased from **281** to **481**, yielding a decrease in the overall fatalities per attack (FPA) from **3.6** to **2.6**. The figure also compares the trajectory in the May 2018 MTI report (grey line) with the 2019 (brown line) data.

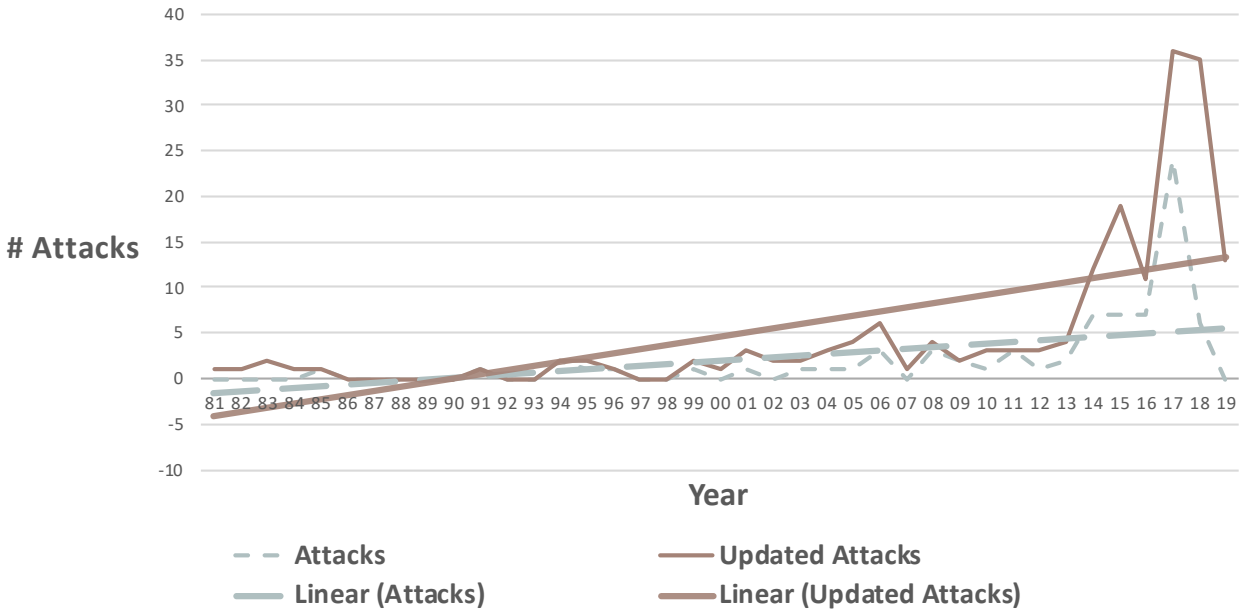

Figure 3. Vehicle Rammings Over Time: 1981 through 9/2019

Lethality is shown for the same period in Figure 4, showing that the addition of new attacks in the 1980s skews the lethality trend line downward for the new data somewhat. This trend is attributable to the very lethal attacks by mentally disturbed persons particularly in China in the 1980s and the addition of more attacks with less lethality in recent years.

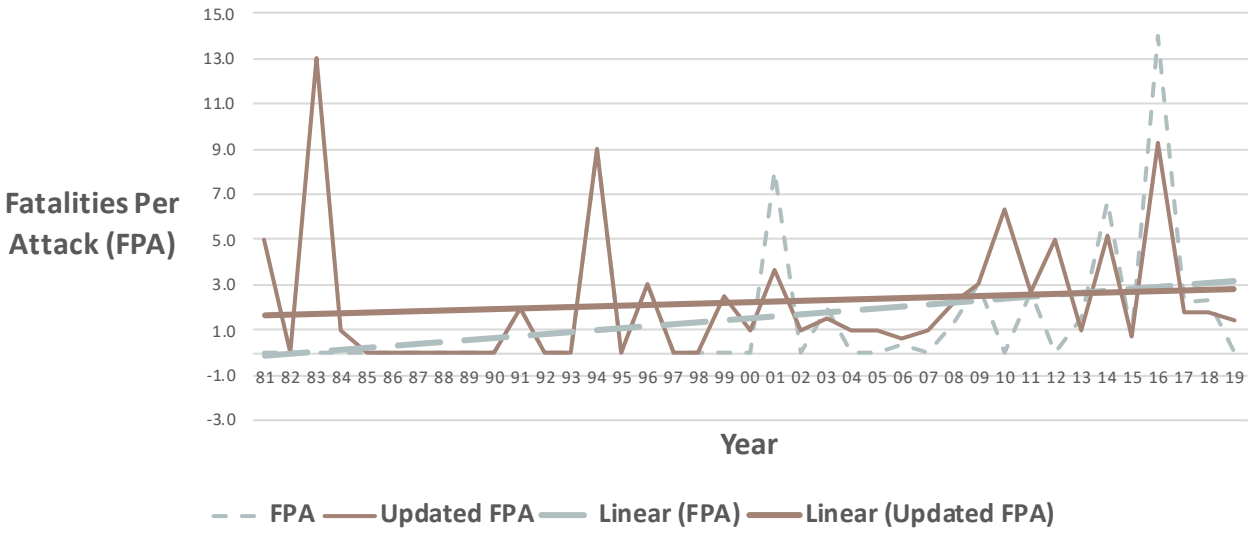

Figure 4. Vehicle Ramming Lethality Over Time: 1981 through 9/2019

GEOGRAPHY: GENERAL COUNTRY GROUPS

Table 1 reproduces the previous (May 2018) data on attacks and lethality divided into the three general geographical categories: Israel and the Palestinian Territories (West Bank and Gaza), Developed Countries, and Developing Countries.[1]

Table 1. All Attacks by General Geographic Categories

	All			Israel & Occupied Territories			Developed Countries			Developing Countries		
5-Year Period	**# A**	**# F**	**FPA**	**# A**	**# F**	**FPA**	**# A**	**# F**	**FPA**	**# A**	**# F**	**FPA**
1973–1978	**1**	**8**	**8.0**	NONE			1	8	8.0	NONE		
1979–1982	**NONE**			NONE			NONE			NONE		
1983–1987	**1**	**0**	**0.0**	NONE			NONE			1	0	0
1988–1992	**1**	**2**	**2.0**	1	2	2.0	NONE			NONE		
1993–1997	**4**	**21**	**5.3**	1	3	3.0	1	0	0.0	2	18	9.0
1998–2002	**3**	**8**	**2.7**	2	8	4.0	1	0	0.0	NONE		
2003–2007	**6**	**3**	**0.5**	NONE			6	3	0.5	NONE		
2008–2012	**9**	**18**	**2.0**	5	5	1.0	3	6	2.0	1	7	7.0
2013–4/2018	**53**	**221**	**4.2**	19	13	0.7	32	163	5.1	2	45	22.5
Total and Averages: 1973 through 4/2018	***78***	***281***	***3.6***	***28***	***31***	***1.1***	***44***	***180***	***4.1***	***6***	***70***	***11.7***

Table 2 shows the revised picture, with the five-year periods slightly changed.

Table 2. All Attacks by General Geographic Categories: Updated

	All			Israel & Occupied Territories			Developed Countries			Developing Countries		
5-Year Period	**# A**	**# F**	**FPA**	**# A**	**# F**	**FPA**	**# A**	**# F**	**FPA**	**# A**	**# F**	**FPA**
1963–1968	**1**	**3**	**3.0**	0	0	0.0	1	3	0.0	0	0	0.0
1969–1973	**1**	**0**	**0.0**	0	0	0.0	1	0	0.0	0	0	0.0
1974–1978	**2**	**8**	**4.0**	0	0	0.0	2	8	0.0	0	0	0.0
1979–1983	**4**	**31**	**7.8**	0	0	0.0	1	5	5.0	3	26	8.7
1984–1988	**2**	**1**	**0.5**	0	0	0.0	1	1	1.0	1	0	0.0
1989–1993	**1**	**2**	**2.0**	1	2	2.0	0	0	0.0	0	0	0.0
1994–1998	**5**	**21**	**4.2**	1	3	3.0	2	0	0.0	2	18	9.0
1999–2003	**9**	**22**	**2.4**	2	8	4.0	4	8	2.0	3	6	2.0
2004–2008	**19**	**21**	**1.1**	2	4	2.0	15	10	0.7	2	7	3.5
2009–2013	**15**	**52**	**3.5**	3	1	0.3	5	8	1.6	7	43	6.1
2014 through 9/2019	**125**	**320**	**2.6**	32	12	0.4	68	173	2.5	25	135	5.4
Total and Averages: 1963 through 9/2019	***184***	***481***	**2.6**	***41***	***30***	**0.7**	***100***	***216***	**2.2**	***43***	***235***	**5.5**

[1] For purposes of this report, developed countries are currently OECD signatories, and developing countries are not currently OECD signatories; we have created a special category for Israel (an OECD signatory country) and the West Bank (part of a non-signatory country) because of the large number of attacks and the unique nature of the Palestinian campaign there.

Comparing the two charts, some things jump out. As we added attacks that have occurred since the last report and found additional attacks from previous years, overall lethality decreased from **3.6** to **2.6** FPA. In Israel and the Palestinian territories, FPA decreased slightly from **1.1** to **0.7**. In the Developed Countries, it decreased from **4.1** to **2.2.** In the Developing Countries, it decreased dramatically from **11.7** to **5.5**. Most of the decreased lethality comes from finding more attacks with few fatalities, mostly by mentally unstable individuals. Initial searches based on media sources invariably capture the more serious incidents—those involving more casualties. More intense searching turns up low-level incidents, which attract less media attention and therefore are harder to identify.

The attacks remain at a low until the 1999–2003 time period and then steadily increase, with a spike between 2004–2008. They then increase dramatically in the last **5.75**-year-period, **2014 through September 2019**. The higher number of attacks is particularly noticeable in the Developed Countries (13 times more than the previous period), and in Israel and the West Bank (11 times more), and it is less so in the Developing Countries (3.5 times more). Lethality per attack increases somewhat for Israel and the West Bank but decreases somewhat for both Developed and Developing Countries.

INDIVIDUAL COUNTRIES BY FREQUENCY OF ATTACK

Table 3 shows the old and new picture of countries ranked by number of attacks. (The older table has been adjusted from the previous report by combining Israel and the West Bank and Gaza Strip into one “country” for the sake of analysis: Israel and the West Bank, since there were no vehicle rammings in the Gaza Strip.)

Table 3. All Attacks by Country by Frequency: Original and Updated

Country	# Attacks	# Fatalities	FPA
Israel & West Bank	28	31	1.1
United States	13	12	0.9
France	10	88	8.8
United Kingdom	5	12	2.4
China	3	52	17.3
Haiti	2	18	9.0
Spain	2	15	7.5
Germany	2	14	7.0
Canada	2	10	5.0
Sweden	2	7	3.5
Austria	2	3	1.5
Czechoslovakia	1	8	8.0
Netherlands	1	6	6.0
Australia	1	5	5.0
Belgium	1	0	0.0
Ireland	1	0	0.0
Japan	1	0	0.0
Sri Lanka	1	0	0.0
Total/Averages	***78***	***281***	***3.6***

Country	# Attacks	# Fatalities	FPA
Israel & West Bank	41	30	0.7
United States	39	25	0.6
China	28	187	6.7
France	14	89	6.4
United Kingdom	10	13	1.3
Germany	7	17	2.4
Japan	6	10	1.7
Australia	5	7	1.4
Russian Federation	3	1	0.3
Sweden	3	7	2.3
Austria	2	3	1.5
Canada	2	10	5.0
Haiti	2	18	9.0
India	2	11	5.5
Ireland	2	1	0.5
Netherlands	2	7	3.5
Spain	2	15	7.5
Belgium	1	0	0.0
Brazil	1	1	1.0
Czechoslovakia	1	8	8.0
Finland	1	1	1.0
Italy	1	0	0.0
Mexico	1	2	2.0
Nigeria	1	8	8.0
Poland	1	0	0.0
Romania	1	0	0.0
Sri Lanka	1	0	0.0
Taiwan	1	3	3.0
Tajikistan	1	4	4.0
Uganda	1	3	3.0
United Arab Emirates	1	0	0.0
Total/Averages	***184***	***481***	***2.6***

Clearly, we have found attacks in more countries, now **31** instead of **18**.

The 2018 MTI report showed that most attacks took place in Israel and the West Bank (with **28** incidents), then the United States (with **13** incidents), followed by France (with **10**), the UK (**5**), and then China (**3**).

In the expanded database, Israel and the West Bank still lead with **41** attacks, while the United States is second (with **39**), then China (with **28**), France (with **14**), the United Kingdom (with **10**), and then Germany (with **7**). The basic order hasn't changed much, except for China, with **25** more incidents, again mostly because of the increased capture of additional attacks

by mentally disturbed individuals.

INDIVIDUAL COUNTRIES RANKED BY LETHALITY

Table 4 compares the findings of the previous analysis and the new picture of countries ranked according to lethality.

Table 4. All Attacks by Country by Lethality: Original and Updated

Country	# Attacks	# Fatalities	FPA
China	3	52	17.3
Haiti	2	18	9.0
France	10	88	8.8
Czechoslovakia	1	8	8.0
Spain	2	15	7.5
Germany	2	14	7.0
Netherlands	1	6	6.0
Canada	2	10	5.0
Australia	1	5	5.0
Sweden	2	7	3.5
United Kingdom	5	12	2.4
Israel	14	26	1.9
Austria	2	3	1.5
United States	13	12	0.9
West Bank and Gaza Strip	14	5	0.4
Belgium	1	0	0.0
Ireland	1	0	0.0
Japan	1	0	0.0
Sri Lanka	1	0	0.0
Total/Averages	***78***	***281***	***3.6***

Country	# Attacks	# Fatalities	FPA
Haiti	2	18	9.0
Czechoslovakia	1	8	8.0
Nigeria	1	8	8.0
Spain	2	15	7.5
China	28	187	6.7
France	14	89	6.4
India	2	11	5.5
Canada	2	10	5.0
Tajikistan	1	4	4.0
Netherlands	2	7	3.5
Taiwan	1	3	3.0
Uganda	1	3	3.0
Germany	7	17	2.4
Sweden	3	7	2.3
Mexico	1	2	2.0
Japan	6	10	1.7
Austria	2	3	1.5
Australia	5	7	1.4
United Kingdom	10	13	1.3
Brazil	1	1	1.0
Finland	1	1	1.0
Israel & West Bank	41	30	0.7
United States	39	25	0.6
Ireland	2	1	0.5
Russian Federation	3	1	0.3
Belgium	1	0	0.0
Italy	1	0	0.0
Poland	1	0	0.0
Romania	1	0	0.0
Sri Lanka	1	0	0.0
United Arab Emirates	1	0	0.0
Total/Averages	***184***	***481***	***2.6***

Previously, lethality was highest in China, then Haiti, France, Czechoslovakia, Spain, Germany, Netherlands, Canada, and Australia, with a worldwide FPA of 3.6. Now, the

highest ranking countries are Haiti, Czechoslovakia, Nigeria, Spain, China, and France, followed by India, Canada, Tajikistan, the Netherlands, Taiwan and Uganda, with a worldwide FPA of 2.6.

With total numbers so small, a single violent incident can distort the results. In the previous analysis, for countries with more than 10 attacks, the only country above the overall average was China. Now, those countries are China and France.

ANALYSIS BY ATTACKER CATEGORIES

The next set of tables compare the current and previous analyses of four main attacker categories in terms of volume of attacks, fatalities, and lethality. These are categories of attackers, not specific groups. They include those inspired by jihadist ideologies, regardless of whether they claim to act on behalf of al Qaeda or ISIS or indicate no apparent preference; Palestinians; right-wing extremists; an assemblage of anti-immigrant, anti-abortion, and other extremist causes; and mentally disturbed or unstable individuals.

The use of terms like “mentally disturbed” or “mentally unstable” takes us into a sensitive area, which merits further discussion. The terms “mentally disturbed” and “mentally unstable” are used here in a generic sense, realizing that, to mental health professionals, they could mean any one of many hundreds of specific mental disorders. And we recognize that temporary but extreme emotional distress or a psychotic episode can propel a person into a homicidal rage, which appears to be the case in some of the incidents.

We are not mental health professionals and have made no independent assessment of any one’s mental state at the time of the incident; nor could we have access to medical reports. Instead, we have relied on what sources reported at the time and what was said, sometimes by the defendants themselves, during subsequent trials.

Many people would consider deliberately driving over pedestrians as bizarre behavior, but some of the drivers also expressed bizarre motives. One woman claimed that she wanted revenge for “the hatred shown to her by her family and the world.” Another wanted revenge because “famous singers had stolen his songs.” One claimed that the devil ordered him to drive over people while another said he heard the “voice of the heavens.”

In some cases, psychiatrists testified that the defendants had a history of delusions or suffered from paranoid schizophrenia. Courts heard arguments that an individual was incompetent to stand trial for reasons of insanity and sometimes, they agreed, but not always--mental competence means something entirely different in the legal context. A number of those convicted of terrorist vehicle ramming attacks also had histories of diagnosed mental illness.

Without offering a specific diagnosis, we believe that the terms “mentally disturbed” or “mentally unstable” can be reasonably applied to these cases, without confirming a specific diagnosis or intending offense. Above all, we do not wish to imply that persons affected by mental health problems should be considered dangerous. Our very strong view is that they need help and intervention. We are talking about a small number of extreme cases—an

average of less than two a year—occurring worldwide over a half century.

Table 5 shows the previous breakdown of attacks, fatalities and FPA for these four main attacker categories: Jihadists, Mentally Disturbed, Palestinian, and Right-Wing Groups or Extremists.

Table 5. All Attacks by Main Attacker Groups in 5-Year Periods

	Jihadist			Palestinian			Mentally Disturbed			Right-Wing Groups or Extremists		
5-Year Period	***# A***	***# F***	***FPA***	***# A***	***# F***	***FPA***	***# A***	***# F***	***FPA***	***# A***	***# F***	***FPA***
1973–1978	NONE			NONE			1	8	8	NONE		
1978–1982	NONE			NONE			NONE			NONE		
1983–1987	NONE			NONE			NONE			NONE		
1988–1992	NONE			1	2	2.0	NONE			NONE		
1993–1997	NONE			1	3	3.0	1	0	0	2	18	9.0
1998–2002	NONE			2	8	4.0	NONE			1	0	0.0
2003–2007	1	0	0.0	NONE			3	3	1	1	0	0.0
2008–2012	NONE			4	5	1.3	2	0	0.0	NONE		
2013 through 4/2018	12	138	11.5	19	13	0.7	12	23	1.9	4	1	0.3
Total/Averages	***13***	***138***	***10.6***	***27***	***31***	***1.1***	***19***	***34***	***1.8***	***8***	***19***	***2.4***

Table 6 shows the more recent analysis of the same groups, which together now account for 160 (87 percent) of the 184 attacks.

Table 6. All Attacks by Main Attacker Groups in 5-Year Periods: Updated

	Jihadist			Palestinian			Mentally Disturbed			Right-Wing Groups or Extremists		
5-Year Period	***# A***	***# F***	***FPA***	***# A***	***# F***	***FPA***	***# A***	***# F***	***FPA***	***# A***	***# F***	***FPA***
1963–1968	NONE			NONE			1	3	3.0	NONE		
1969–1973	NONE			NONE			1	0	0.0	NONE		
1974–1978	NONE			NONE			2	8	4.0	NONE		
1979–1983	NONE			NONE			4	31	7.8	NONE		
1984–1988	NONE			NONE			1	1	1.0	NONE		
1989–1993	NONE			1	2	2.0	0	0	0.0	NONE		
1994–1998	NONE			1	3	3.0	2	0	0.0	2	18	9.0
1999–2003	NONE			2	8	4.0	5	11	2.2	1	0	0.0
2004–2008	1	0	0	1	4	4.0	14	17	1.2	1	0	0.0
2009–2013	NONE			3	1	0.3	8	36	4.5	NONE		
2014 through 9/ 2019	18	144	8.0	32	12	0.4	53	102	1.9	6	1	0.3
Total/Averages	***19***	***144***	***7.6***	***40***	***30***	***0.8***	***91***	***209***	***2.3***	***10***	***19***	***1.9***

Several things jump out here:

Jihadists: The total number of Jihadist attacks increases from **13** to **19**. The additional cases have all occurred in the most recent period. The lethality of Jihadist attacks, however, went down from **10.6** FPA to **7.6** FPA—the additional attacks diluted the

effect of the attack in Nice, France. Still, except for the Uighur attacks in China, Jihadist attacks have the highest lethality.

Palestinians: We added 13 attacks, including those that were missed in the earlier analysis. Their overall lethality remains low, dropping from an FPA of **1.1** to **0.8.**

Mentally Disturbed: Many more attacks were added, bringing the total to 91 instead of the 19 included in the first cut. Some of these caused significant casualties, but many appear more spontaneous and were not particularly well planned. The overall lethality for this category did go up somewhat from an FPA of **1.8** to **2.3**. They remain considerably less lethal than jihadists.

Right-Wing Groups: Two more attacks were added to the current period of time, with lethality dropping from and FPA of **2.4** to **1.9**

Table 7 charts the specific attacker groups, ranked by number of attacks, highlighting those whose FPA is the overall average, according to the first analysis.

Table 7. All Attacks By Specific Attacker Groups by Frequency

Attacker Groups	# Attacks	# Fatalities	FPA
Palestinian without a specific Islamic group affiliation	22	20	0.9
Mentally-Disturbed Individual, Confirmed or Highly Likely	17	33	1.9
Jihadist, Confirmed or Highly Likely	8	133	16.6
Right-Wing Extremist Individuals or Groups	8	19	2.4
Unknown Motive	6	7	1.2
Jihadist, Possible	5	5	1.0
Palestinian Group, Non-Jihadist	5	11	2.2
Uighur Separatists	3	52	17.3
Mentally Disturbed Individual, Possible	2	1	0.5
Irish Protestant Groups	1	0	0.0
Tamil Groups	1	0	0.0
Total/Averages	***78***	***281***	***3.6***

The new depiction appears in Table 8.

Table 8. All Attacks By Specific Attacker Groups by Frequency: Updated

Attacker Groups	# Attacks	# Fatalities	FPA
Mentally Disturbed Individual, Confirmed or Highly Likely	71	175	2.5
Palestinian without a specific Islamic group affiliation	35	19	0.5
Mentally Disturbed Individual, Possible	20	34	1.7
Unknown Motive	17	27	1.6
Jihadist, Confirmed or Highly Likely	12	138	11.5
Right-Wing Extremist Individuals or Groups	11	20	1.8
Jihadist, Possible	6	5	0.8
Palestinian Group, Non-Jihadist	5	11	2.2
Uighur Separatists	3	52	17.3
Unknown Group	2	0	0.0
Irish Protestant Groups	1	0	0.0
Tamil Groups	1	0	0.0
Total/Averages	***184***	***481***	***2.6***

In terms of frequency, there are more attacks by Palestinian and mentally disturbed or unstable assailants, who now account for a majority of the attacks.

In terms of lethality, though, the only two specific sets that are above the overall average in both data sets are attacks confirmed or highly likely carried out by Uighurs and jihadists.

Tables 9 and 10 compare the use of suicide attacks by the attacker category. In the most recent analysis (Table 10), which has been expanded to include all categories, jihadists have the highest percentage of suicide attacks, except for Uighur groups—all three of the Uighur attacks were suicide operations. Mentally disturbed attackers account for the highest total number of suicide attacks, but these comprise only 16 percent of the total.

Table 9. Percentage of Suicide Attacks by Attacker Category

Attacker Type	Suicide Attacks	All Attacks	% of All Attacks
Jihadist	6	13	46%
Mentally Disturbed	5	19	26%
Palestinian	6	27	22%
Right Wing	1	8	13%

Table 10. Percentage of Suicide Attacks by Attacker Category: Updated

Attacker Type	Suicide Attacks	All Attacks	% of All Attacks
Uighur Groups	3	3	100%
Jihadist	7	19	37%
Palestinian	7	40	18%
Mentally Disturbed	15	91	16%
Right Wing	0	10	0%
Unknown or Other	0	21	0%

As Figure 5 shows, vehicle ramming attacks by Jihadist groups increased sharply after 2006 when the first such attack took place. The driver in the 2006 case did not claim specific affiliation with al Qaeda or Jihadist ideology, but said he carried out the attack "to avenge the deaths of Muslims around the world." We have labeled it a Jihadist attack. Attacks by mentally disturbed individuals increased even more rapidly than Jihadist attacks.

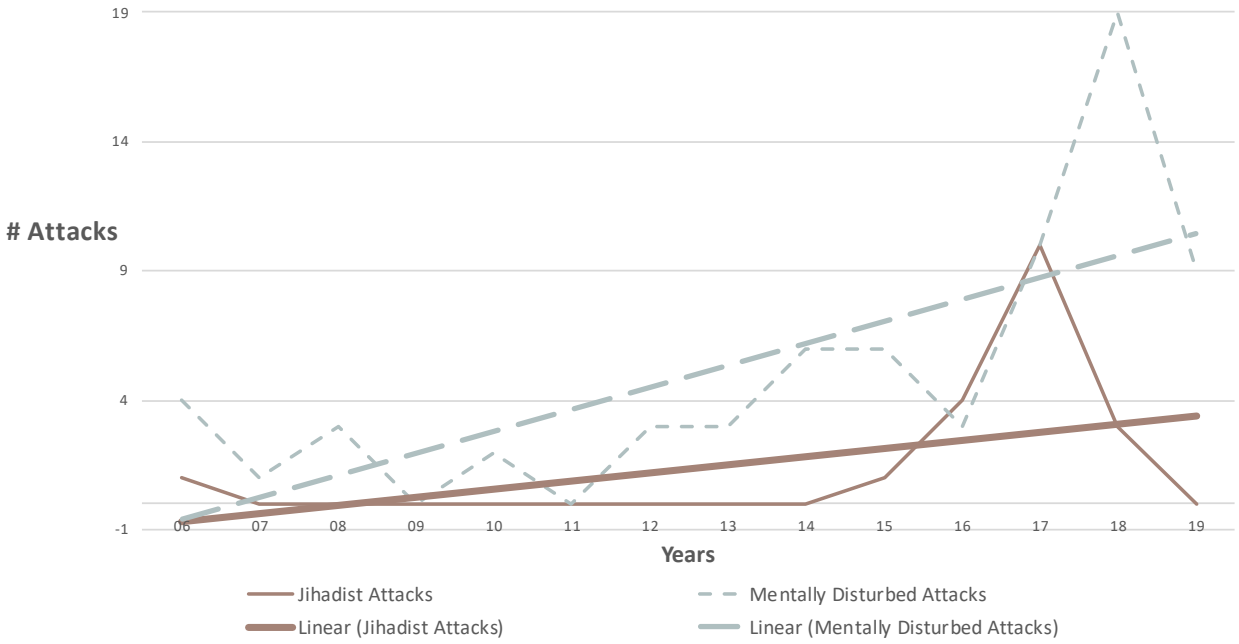

Figure 5. Jihadist versus Mentally Disturbed Vehicle Rammings Over Time: 2006 through Sept 2019

As Figure 6 shows, the lethality of JIhadist attacks also increased sharply, especially in 2016, the year of the attack in Nice. The lethality of attacks by mentally disturbed persons shows a less dramatic increase. (Uighur separatists in China are the most lethal attackers, but they account for only three incidents.)

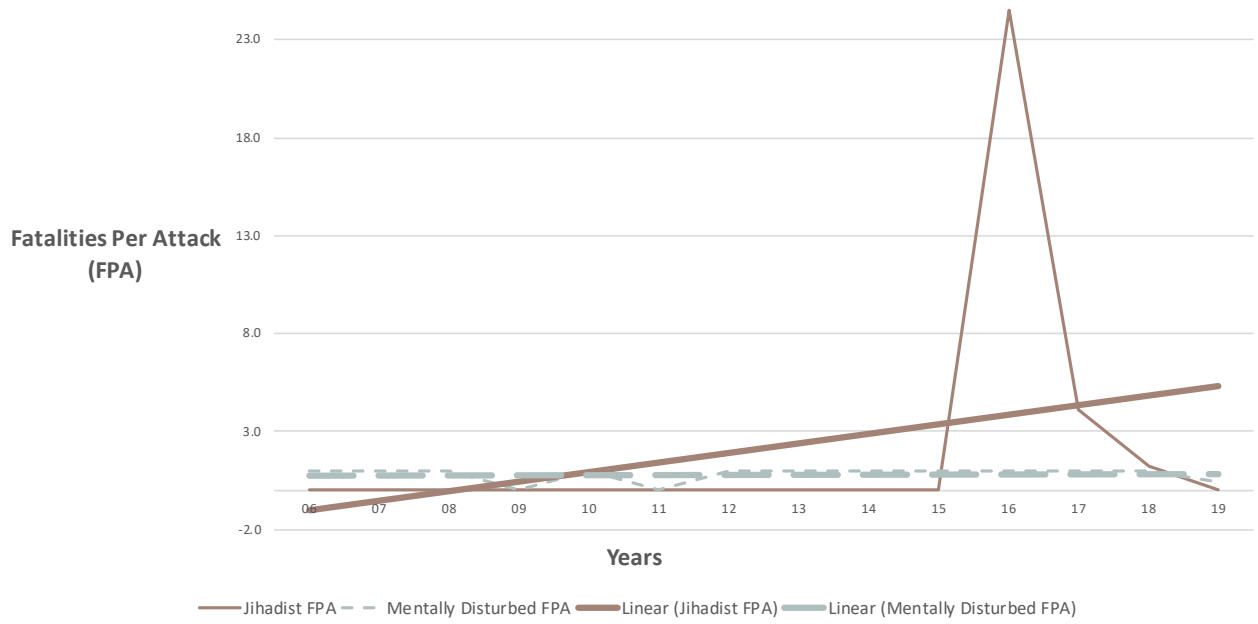

Figure 6. Jihadist versus Mentally Disturbed Vehicle Ramming Lethality Over Time: 2006 through September 2019

TARGET CATEGORIES

The next section of the report examines target categories. What kinds of venues are most frequently selected by the attackers and where do they achieve their highest lethality? Tables 11 and 12 compare the previous and the more recent analysis in terms of frequency.

Table 11. All Attacks by Target Group by Frequency

Target Group	# Attacks	# Fatalities	FPA
Bus Stations or Stops	18	22	1.2
Public Streets: Vehicle Access	15	25	1.7
Public Streets: Pedestrianized	10	34	3.4
Public Gathering: Demonstration, Other	5	110	22.0
Medical Facility	4	0	0.0
Religious Institution (or Guards protecting them)	4	0	0.0
Public Gathering: Market (religious or open)	3	55	18.3
Public Streets: Pedestrianized & Vehicle Access	3	17	5.7
Train Stations and Stops	3	10	3.3
Buses	3	5	1.7
Military or Police Forces protecting a public street	3	2	0.7
Area outside Public Building	3	1	0.3
Entertainment	2	0	0.0
Public Road Infrastructure	1	0	0.0
Public Stores	1	0	0.0
Total/Averages	***78***	***281***	***3.6***

Table 12. All Attacks by Target Group by Frequency: Updated

Target Group	# Attacks	# Fatalities	FPA
Public Streets: Vehicle Access	60	120	2.0
Bus Stations or Stops	25	39	1.6
Public Streets: Pedestrianized	15	43	2.9
Public Gathering: Demonstration, Other	14	117	8.4
Public Gathering: Religious Event or Open Market	13	90	6.9
Entertainment	11	28	2.5
Religious Institution (or Guards protecting them)	9	1	0.1
Educational Institution	7	12	1.7
Other Public Building	6	0	0.0
Military or Police Forces protecting a public street	5	0	0.0
Area outside Other Public Building	4	1	0.3
Medical Facility	4	0	0.0
Public Streets: Pedestrianized & Vehicle Access	3	13	4.3
Train Stations and Stops	3	13	4.3
Airport Public Area	2	0	0.0
Buses	2	4	2.0
Public Road Infrastructure	1	0	0.0
Total/Averages	***184***	***481***	***2.6***

Bus stops were identified as the most frequent venue for vehicle ramming attacks in the previous analysis. The expanded analysis shows the greatest number of attacks on public streets with vehicle access, followed by bus stations and stops. Public gatherings then follow, as previously, but in a slightly different order.

A different picture emerges when the attack venues are ranked by lethality, as shown in Tables 13 (reflecting the previous MTI report) and 14 (reflecting the current expanded report).

Table 13. All Attacks by Target Group Lethality

Target Group	# Attacks	# Fatalities	FPA
Public Gathering: Demonstration, Other	5	110	22.0
Public Gathering: Market (religious or open)	3	55	18.3
Public Streets: Pedestrianized & Vehicle Access	3	17	5.7
Public Streets: Pedestrianized	10	34	3.4
Train Stations and Stops	3	10	3.3
Public Streets: Vehicle Access	15	25	1.7
Buses	3	5	1.7
Bus Stations or Stops	18	22	1.2
Military or Police Forces protecting a public street	3	2	0.7
Area outside Public Building	3	1	0.3
Medical Facility	4	0	0.0
Religious Institution (or Guards protecting them)	4	0	0.0
Entertainment	2	0	0.0
Public Road Infrastructure	1	0	0.0
Public Stores	1	0	0.0
Total/Averages	***78***	***281***	***3.6***

Table 14. All Attacks by Target Group Lethality: Updated

Target Group	# Attacks	# Fatalities	FPA
Public Gathering: Demonstration, Other	14	117	8.4
Public Gathering: Religious Event or Open Market	13	90	6.9
Public Streets: Pedestrianized & Vehicle Access	3	13	4.3
Train Stations and Stops	3	13	4.3
Public Streets: Pedestrianized	15	43	2.9
Entertainment	11	28	2.5
Buses	2	4	2.0
Public Streets: Vehicle Access	60	120	2.0
Educational Institution	7	12	1.7
Bus Stations or Stops	25	39	1.6
Area outside Other Public Building	4	1	0.3
Religious Institution (or Guards protecting them)	9	1	0.1
Airport Public Area	2	0	0.0
Medical Facility	4	0	0.0
Military or Police Forces protecting a public street	5	0	0.0
Other Public Building	6	0	0.0
Public Road Infrastructure	1	0	0.0
Total/Averages	***184***	***481***	***2.6***

Although the FPA data occasionally drop considerably—as they did with some sets of public gatherings involving demonstrations, religious events, or open markets—the overall rankings change very little. The most lethal attacks still occur when vehicles plow into public gatherings. Train stations and stops come next, followed by pedestrianized public streets. Whether they are pedestrianized or not makes a difference. Attacks on pedestrianized streets yield an FPA of 2.9; attacks on streets with ordinary vehicle traffic yield an FPA of only 2.0, lower than the overall average of 2.6.

Public plazas immediately adjacent to train stations are now also venues where attacks above the overall average lethality occur, but the number of such incidents is low and this may just be a consequence of small numbers.

TARGET SELECTION AND LETHALITY

The next section combines target frequencies and resulting casualties over time. The objective here is to look at trends. To simplify matters, venues are aggregated into four columns:

The first column, “ALL,” comprises the total number of attacks, the total number of fatalities, and the average FPA for attacks at all venues in five-year periods.

The second column, “PUBLIC GATHERINGS,” comprises public gatherings of all types, including open air markets, celebrations, parades, as well as pedestrianized public streets and promenades.

The third column, “PUBLIC STREETS WITH VEHICULAR ACCESS,” combines

ordinary streets, including areas around public surface transportation such as bus stops and train stations.

The fourth column, “PUBLIC BUILDINGS,” includes those attacks where vehicles are deliberate rammed into municipal or commercial buildings.

The results are shown in Table 15, which is our most recent analysis.

Table 15. All Attacks by Target Category in 5-Year Periods

	All			Public Gatherings			Public Streets with Vehicular Access			Public Buildings		
5-Year Period	**#A**	**#F**	**FPA**	**#A**	**#F**	**FPA**	**#A**	**#F**	**FPA**	**#A**	**#F**	**FPA**
1963–1968	1	3	3.0	NONE	0		1	3	3.0	NONE	0	
1969–1973	1	0	0.0	NONE	0		NONE	0		1	0	
1974–1978	2	8	4.0	1	0	0	1	8	8.0	NONE	0	
1979–1983	4	31	7.8	1	5	5	1	0	0.0	2	26	13
1984–1988	2	1	0.5	NONE	0		1	1	1.0	1	0	0
1989–1993	1	2	2.0	NONE	0		1	2	2.0	NONE	0	
1994–1998	5	21	4.2	2	18	9.0	3	3	1.0	NONE	0	
1999–2003	9	22	2.4	2	5	2.5	3	13	4.3	4	4	1.0
2004–2008	19	21	1.1	5	4	0.8	7	11	1.6	6	6	1.0
2009–2013	15	52	3.5	4	9	2.3	9	43	4.8	2	0	0.0
2014–Though 9/2019	125	320	2.6	23	210	9.1	78	104	1.3	25	6	0.2
Total: 1963 through 9/2019	***184***	***481***	***2.6***	***38***	***251***	***6.6***	***105***	***188***	***1.8***	***41***	***42***	***1.0***

[a] Includes markets, celebrations, pedestrianized public streets, etc.

[b] Includes public surface transport, aviation, and public road infrastructure.

[c] Includes areas outside public buildings.

Public streets and locations adjacent to public surface transport are the most frequent venues for vehicle ramming attacks, accounting for **105** of the incidents. Public buildings and areas outside of them come in second place with **41** incidents. Public gatherings, including pedestrianized streets, follow with **38** incidents.

In terms of lethality, however, vehicle ramming attacks on public gatherings (with pedestrianized streets included) account for the most fatalities and have the highest lethality by far at **6.6** FPA. Public streets with vehicular access plus public surface transport venues account for fewer fatalities overall and have a lower FPA of **1.8**. Finally, vehicle ramming attacks on public buildings account for the fewest fatalities and have the lowest FPA at **1.0**. Interestingly, lethality for public gatherings reached a high in the last five-year period, for public streets in the previous five-year period, and for public buildings back in the 1979–1983 period.

HOW ATTACKERS TRY TO INCREASE LETHALITY

Suicide drivers proved to be significantly more lethal than non-suicidal drivers. Table 16 shows that the overall average FPA is 2.6. For non-suicide attacks, the average FPA is 1.8. When confirmed and possible suicide attacks are combined, the average FPA is 6.6.

Table 16. Suicide and Non-Suicide Attacks by Lethality

Suicide Category	# Attacks	# Fatalities	FPA
Possible	15	129	8.6
Yes	17	81	4.8
Unknown: Attacker(s) not killed or injured	10	25	2.5
No	132	241	1.8
Unknown: Attacker(s) killed or injured	10	5	0.5
Totals/Averages	***184***	***481***	***2.6***

Other things drivers have done to increase fatalities include swerving the vehicle back and forth as opposed to a straight-line attack or continuing the attack with stabbings or arson devices. As Table 17 shows, there is only one attack—the 2014 attack by Uighur separatists in China—where suicide attackers, driving two vehicles, swerved them back and forth while throwing explosive or incendiary devices out of the windows as the two cars careened through the crowd. The attack resulted in 43 fatalities, although since it involved two vehicles, it might be considered two simultaneous attacks.

Suicide attackers were able to increase the FPA from an average of 2.6 to 8.4, a net improvement of 5.8. Swerving the vehicle alone adds 2.0 to the average FPA. Swerving the vehicle combined with continuing the attack with stabbings, as in the June 2017 London Bridge/Borough Market attack, adds 1.4 to the average FPA. Continuing the attack with stabbing only *reduces* FPA by 0.7, while continuing the attack with arson *reduces* it by 2.6. The variations reflect very few cases. The only thing that can be said with confidence is that suicide attacks are deadlier and swerving the vehicle adds casualties.

Table 17. Lethality Enhancers by Increase of FPA

Lethality Multiplier	# Attacks	# Fatalities	FPA	FPA > 2.6 Average
Suicide+Swerving+Throwing IIDs from the Vehicle (e.g., Uighur Attack in China)	1	43	43.0	**40.4**
Suicide (yes or possible) only	32	210	8.4	**5.8**
Vehicle Swerve only (yes or probable)	60	278	4.6	**2.0**
Suicide+Swerving+Attack continued with Stabbings (e.g., London)	3	12	4.0	**1.4**
Attack Continued with Stabbings only (yes and possible)	25	48	1.9	**-0.7**
Attack Continued with Arson only	5	0	0.0	**-2.6**

DOES PLANNING INCREASE LETHALITY?

The number of attackers combined with the use of other tactics than vehicle ramming suggests greater planning as opposed to the more impulsive attacks carried out often by mentally unstable individuals, especially when multiple attackers continue the attack after ramming, stabbing or shooting additional victims or detonating explosive or incendiary devices.

The question is, are more people killed to any significant degree? Looking at the number of attackers and tactics, the answer, as hinted at above, continues to be no. When two

high-lethality events are set aside (a single attacker on the 2016 Bastille Day in Nice which killed 86, and a 2014 attack by multiple Uighur attackers in two vehicles in Umpqua, China that killed 43), lethality is not enhanced.

Number of Attackers

As Table 18 shows, 168 or 91% of the attacks were conducted by a single perpetrator, and only 12 attacks were conducted by more than one attacker: five by 2 people, five by 3 people, and two by 5 people. (There are four older attacks from prior databases that do not allow us to know or estimate the number of attackers.)

Table 18. Number of Attackers by Frequency

Perpetrator Fatality Category by Attack	# Attacks	% of all Attacks
Single Attackers, Attacker not Killed	129	70.1%
Single Attackers, Attacker Killed	39	21.2%
Multiple Attackers, No Attackers Killed	2	1.1%
Multiple Attackers, Some or All Attackers Killed	10	5.4%
Unknown, No Fatalities	4	2.2%
Total/Percentages	***184***	***100%***

The fatalities and injuries that the attackers themselves suffered suggests determination. It is perhaps not surprising that in 129 or 77% of the 168 “single-attacker” cases, none of the attackers were killed at the scene of the attack; in 39 of these 129 attacks, the attacker was killed. By contrast, in the attacks involving more than one attacker, all or some of the attackers were killed in 10 (or 83%) of the 12 attacks. There were only two events involving more than one attacker in which none of the attackers were killed or injured: the 2002 attack on a Synagogue in France by right-wing extremists and a 2004 attack against a pub In Northern Ireland by Protestant extremists.

Looking at all 203 attackers from our data known to have participated in these vehicle ramming attacks, 63 were killed (or 31%) at the scene of the attack, while another 25 were injured.

Table 19. Number of Attackers and Lethality Enhancers by Frequency

Type of Attack	# Attacks	# Fatalities	FPA
Single Attacker, No Attack Method other than Vehicle Ramming (includes 4 older cases where details are unknown)	136	253	1.9
Single Attacker, Attack continued after Ramming	27	38	1.4
Single Attacker, Automatic/Semi-Automatic Weapons used inside Vehicle (Nice’s 86 casualties excluded)	5	7	1.4
Multiple Attackers, No Attack Method other than Vehicle Ramming	4	10	2.5
Multiple Attackers, Other Attack means used in Vehicle or after Ramming	8	58	7.3

Looking further at single versus multiple attackers in Table 19 above, we see that of the 168 single-perpetrator attacks, in 136 (81%) of the cases, the attacker neither used another

attack method while still in the vehicle nor continued the attack after the ramming. (We assume that the four older attacks for which there were little data involved single attackers and only a vehicle.) The average number of fatalities per attack in these cases was 1.9. The lethality attained in the 27 incidents (16% of the single-attacker incidents) where the attack was continued after the ramming—there were 38 people killed—actually decreased to an FPA of 1.4. The remaining 5 attacks (3%) where automatic weapons were used while the attacker was still inside the car—excluding the case in Nice, which is a special case—killed only 7 people, providing the same lethality (1.4 FPA). Excluding Nice, when single attackers were involved, *lethality was lower than the overall average of 2.6 and even dropped when the attack was continued from inside the vehicle or outside after the ramming*.

The situation for multiple attackers is oddly similar. When we look at those 12 attacks, there were only 4 cases where the attackers neither used weapons or explosive devices while inside the car nor continued the attack after the ramming, and in only 2 were there fatalities. During Easter 2019, two attackers rammed a vehicle into an Easter procession of youths in Gombe, Nigeria, killing 8 and injuring 17 (the two attackers were killed by the avenging mob). Earlier, in 2013, a group of Uighurs killed two in a suicide attack in Tiananmen Square. *The FPA for these 4 attacks is therefore 2.5, only slightly below the overall average of 2.6*.

In the remaining 8 attacks, where the perpetrators either fired weapons or threw explosive devices out of the windows, or continued the attack with various weapons after the ramming, a total of 58 people were killed, giving a much higher FPA of 7.3, which is 2.8 times more than the overall FPA of 2.6. *However*, a majority of the 58 fatalities resulted from a single incident in China where two sport utility vehicles carrying 5 attackers rammed through crowds at a busy street market. As the vehicles careened through the fleeing shoppers, the assailants threw explosive devices out of the windows. The vehicles then smashed into each other and exploded. In all, 43 persons were killed and more than 90 were injured. Distortion by a single incident is always a problem when dealing with a small number of incidents. *If the Urumqi attack is set aside, the FPA of the remaining 7 attacks is 1.9, which is below the overall average.*

Vehicle Acquisition

How the vehicle is acquired is another, perhaps better indicator of planning. As Table 20 indicates, the most common means (71%) of attaining a vehicle was by owning it, either personally or as part of a family. Other means of attaining a vehicle include theft (9.2%), renting (5.4%), using a vehicle as an employee (4.3%), and hijacking (2.2%).

Table 20. Vehicle Acquisition Method by Frequency

Vehicle Acquisition Method	# Attacks	% Attacks	# Fatalities	FPA
Owned or Presumed Owned Personal (121) or Family (3) Vehicle	131	71.2%	219	1.7
Stolen	17	9.2%	30	1.8
Unknown or TBD	12	6.5%	30	2.5
Rented	10	5.4%	141	14.1
Operated as an employee	8	4.3%	39	4.9
Hijacked	4	2.2%	22	5.5
Borrowed	1	0.5%	0	0.0
Presumed Owned and then Rented, two vehicles used	1	0.5%	0	0.0
Totals/Averages	***184***	***100.0%***	***481***	***2.6***

But turning to lethality in Table 21, we find the lethality attained by those who used their own or their family car was relatively low—1.7 FPA. By contrast, the most lethal attacks involve rented vehicles. The have an average FPA of 14.1, although again this reflects the attack in Nice, France. Without the episode, attacks with rented vehicles still have an FPA of 5.1, which is higher than average. The next most lethal acquisition method is hijacking a vehicle, with an even higher FPA of 5.5. Attacks using a company vehicle—often construction equipment—achieve an FPA of 4.9. All other acquisition methods do not boost overall lethality.

While exact vehicle types are hard to find in older attacks, we do know that 8 of the 12 rented vehicles were trucks or vans and that of the 21 vehicles stolen or hijacked, 12 were larger vehicles—trucks, buses, or construction equipment.

This suggests that planned rentals, hijackings, and thefts often, but not always, aim at acquiring larger vehicles which can be more lethal.

Table 21. Vehicle Acquisition Method by Lethality

Vehicle Acquisition Method	# Attacks	% Attacks	# Fatalities	FPA
Rented	10	5.4%	141	14.1
Hijacked	4	2.2%	22	5.5
Operated as an employee	8	4.3%	39	4.9
Unknown or TBD	12	6.5%	30	2.5
Stolen	17	9.2%	30	1.8
Owned or Presumed Owned Personal (121) or Family (3) Vehicle	131	71.2%	219	1.7
Borrowed	1	0.5%	0	0.0
Presumed Owned and then Rented, two vehicles used	1	0.5%	0	0.0
Totals/Averages	***184***	***100.0%***	***481***	***2.6***

VII. 2014–2019 ANALYSIS

Given the dramatic increase in the number of vehicle ramming attacks since 2014, we decided to isolate this most recent period from the longer-term analysis. These five-and-three-quarter years account for 125 attacks or 68% of the total.

Table 22 shows the total attacks, fatalities, and FPA for this period. It shows an increasing number of incidents to a high plateau in 2017 and 2018, then falling sharply in the first nine months of 2019. Lethality increases dramatically in 2016, but this increase results from the Nice attack in which 86 people were killed. Setting aside that attack gives 1.5 as the FPA for 2016.

Table 22. 2014 through 9/2019: Attacks by Year

Year	Attacks	% of 14–19 Attacks	Fatalities	FPA
2014	11	8.8%	62	5.6
2015	19	15.2%	13	0.7
2016	11	8.8%	102	9.3
2017	36	28.8%	63	1.8
2018	35	28.0%	61	1.7
2019	13	10.4%	19	1.5
Total/Averages	***125***	***100.0%***	***320***	***2.6***

Table 23 shows the same data disaggregated into three main attacker types. Mentally disturbed attackers continue to predominate, accounting for 42% of the attacks and 32% of the fatalities. Palestinian attackers account for 26% of the attacks but 4% of the fatalities. Jihadist attacks are only 14% of the total but they are by far the most lethal attackers, with an FPA of 8.0 and accounting for 45% of the fatalities (owing in part to the 2016 Nice attack).

Table 23. 2014 through 9/2019: Attacks by General Attacker Category by Year

	All			Jihadist			Mentally Disturbed			Palestinian		
Year	*# A*	*# F*	*FPA*	*# A*	*# F*	*FPA*	*# A*	*# F*	*FPA*	*# A*	*# F*	*FPA*
2014	11	62	5.6	0	0	0.0	6	15	2.5	4	4	1.0
2015	19	13	0.7	1	0	0.0	6	10	1.7	12	3	0.3
2016	11	102	9.3	4	98	24.5	3	4	1.3	3	0	0.0
2017	36	63	1.8	10	41	4.1	10	15	1.5	7	5	0.7
2018	35	61	1.7	3	5	1.7	19	54	2.8	5	0	0.0
2019	13	19	1.5	0	0	0.0	9	4	0.4	1	0	0.0
Totals/Averages	***125***	***320***	***2.6***	***18***	***144***	***8.0***	***53***	***102***	***1.9***	***32***	***12***	***0.4***

Table 24 shows the breakdown into three main venue types. Vehicle ramming attacks on public gatherings, including street markets and pedestrianized streets, result in a high number of fatalities (66% of the total) and the highest FPA (9.1). Again, the Nice attack distorts the numbers. If this incident is set aside, the FPA drops to 5.3, which is still more than the average and considerably above the other two major target categories.

Table 24. 2014 through 9/2019: Attacks by General Attacker Category by Target Category

	All			Public Gatherings			Public Streets with Vehicular Access			Public Buildings		
Year	**#A**	**#F**	**FPA**	**#A**	**#F**	**FPA**	**#A**	**#F**	**FPA**	**#A**	**#F**	**FPA**
2014	11	62	5.6	3	43	14.3	8	19	2.4	0	0	0.0
2015	19	13	0.7	0	0	0.0	18	13	0.7	1	0	0.0
2016	11	102	9.3	3	98	32.7	3	0	0.0	5	4	0.8
2017	36	63	1.8	11	42	3.8	20	19	1.0	5	2	0.4
2018	35	61	1.7	3	18	6.0	22	43	2.0	10	0	0.0
2019	13	19	1.5	3	9	3.0	7	10	1.4	3	0	0.0
Total/Averages	**125**	**320**	**2.6**	**23**	**210**	**9.1**	**78**	**104**	**1.3**	**24**	**6**	**0.3**

[a] Includes markets, celebrations, pedestrianized public streets, etc.

[b] Includes public surface transport, aviation, and public road infrastructure.

[c] Includes areas outside public buildings.

The following two tables look at target venues in greater detail. Table 25 shows that most vehicle ramming attacks occur on ordinary public streets, followed by bus stops (mainly in Israel), then religious or open market public gatherings, then pedestrianized streets. Table 26 gives the same information ranked by FPA instead of volume. It shows that the highest-lethality attacks occur at public gatherings (again distorted by the Nice attack), and streets restricted to pedestrians or which have pedestrianized strips on them. Those are the only target groups where lethality is above the overall average of 2.6 FPA.

Table 25. 2014 through 9/2019: Attacks by Target Group by Frequency

Target Group	# Attacks	# Fatalities	FPA
Public Streets: Vehicle Access	43	66	1.5
Bus Stations or Stops	21	26	1.2
Public Gathering: Religious Event or Open Market	13	90	6.9
Public Streets: Pedestrianized	8	30	3.8
Religious Institution (or Guards protecting them)	8	1	0.1
Public Gathering: Demonstration, Other	6	89	14.8
Area outside Other Public Building	4	1	0.3
Entertainment	4	0	0.0
Military or Police Forces protecting a public street	4	0	0.0
Other Public Building	4	0	0.0
Public Streets: Pedestrianized & Vehicle Access	3	13	4.3
Airport Public Area	2	0	0.0
Educational Institution	2	4	2.0
Medical Facility	2	0	0.0
Train Stations and Stops	1	0	0.0
Total/Averages	***125***	***320***	***2.6***

Table 26. 2014 through 9/2019: Attacks by Target Group by Lethality

Target Group	# Attacks	# Fatalities	FPA
Public Gathering: Demonstration, Other	6	89	14.8
Public Gathering: Religious Event or Open Market	13	90	6.9
Public Streets: Pedestrianized & Vehicle Access	3	13	4.3
Public Streets: Pedestrianized	8	30	3.8
Educational Institution	2	4	2.0
Public Streets: Vehicle Access	43	66	1.5
Bus Stations or Stops	21	26	1.2
Area outside Other Public Building	4	1	0.3
Religious Institution (or Guards protecting them)	8	1	0.1
Airport Public Area	2	0	0.0
Entertainment	4	0	0.0
Medical Facility	2	0	0.0
Military or Police Forces protecting a public street	4	0	0.0
Other Public Building	4	0	0.0
Train Stations and Stops	1	0	0.0
Total/Averages	***125***	***320***	***2.6***

The next two charts—Tables 27 and 28—provide an idea of where these attacks are occurring. As indicated in Table 27, the majority of the vehicle ramming attacks since the beginning of 2014 have occurred in Developed Countries, although lethality is nearly twice as high in Developing Countries.

Table 27. 2014 through 9/2019: Attacks by General Geographic Group

	All			Israel & Occupied Territories			Developed Countries			Developing Countries		
Year	***#A***	***#F***	***FPA***	***#A***	***#F***	***FPA***	***#A***	***#F***	***FPA***	***#A***	***#F***	***FPA***
2014	**11**	**62**	5.6	4	4	1.0	4	6	1.5	3	52	17.3
2015	**19**	**13**	0.7	12	3	0.3	4	4	1.0	3	6	2.0
2016	**11**	**102**	9.3	3	0	0.0	7	98	14.0	1	4	4.0
2017	**36**	**63**	1.8	7	5	0.7	25	48	1.9	4	10	2.5
2018	**35**	**61**	1.7	5	0	0.0	20	15	0.8	10	46	4.6
2019	**13**	**19**	1.5	1	0	0.0	8	2	0.3	4	17	4.3
Total and Averages	***125***	***320***	***2.6***	***32***	***12***	***0.4***	***68***	***173***	***2.5***	***25***	***135***	***5.4***

As Table 28 indicates, Israel and the West Bank account for 32 or slightly more than a quarter of the attacks. This is followed by the United States, China, and France. European countries account for 38 of the attacks.

Table 28. 2014 through 9/2019: Attacks by Country Ranked by Frequency

Country	# Attacks	# Fatalities	FPA
Israel & West Bank	32	12	0.4
United States	24	19	0.8
China	16	119	7.4
France	12	88	7.3
United Kingdom	9	13	1.4
Germany	5	16	3.2
Australia	4	2	0.5
Russian Federation	3	1	0.3
Austria	2	3	1.5
Canada	2	10	5.0
Spain	2	15	7.5
Sweden	2	5	2.5
Belgium	1	0	0.0
Brazil	1	1	1.0
Finland	1	1	1.0
India	1	2	2.0
Italy	1	0	0.0
Japan	1	0	0.0
Netherlands	1	1	1.0
Nigeria	1	8	8.0
Poland	1	0	0.0
Romania	1	0	0.0
Tajikistan	1	4	4.0
United Arab Emirates	1	0	0.0
TOTAL/AVERAGES	125	320	2.6

Table 29 ranks the same information according to lethality. Except for a recent single attack in Nigeria, the two attacks in Spain have the highest FPA (7.5), followed by China (7.4), France (7.3), Canada (5.0), Tajikistan (4.0), and Germany (3.2). All other countries have an FPA lower than the overall average. It's important to note, however, that these rankings often reflect a single to very few attacks and therefore do not warrant high confidence.

Table 29. 2014 through 9/2019: Attacks by Country Ranked by Lethality

Country	# Attacks	# Fatalities	FPA
Nigeria	1	8	8.0
Spain	2	15	7.5
China	16	119	7.4
France	12	88	7.3
Canada	2	10	5.0
Tajikistan	1	4	4.0
Germany	5	16	3.2
Sweden	2	5	2.5
India	1	2	2.0
Austria	2	3	1.5
United Kingdom	9	13	1.4
Brazil	1	1	1.0
Finland	1	1	1.0
Netherlands	1	1	1.0
United States	24	19	0.8
Australia	4	2	0.5
Israel & West Bank	32	12	0.4
Russian Federation	3	1	0.3
Belgium	1	0	0.0
Italy	1	0	0.0
Japan	1	0	0.0
Poland	1	0	0.0
Romania	1	0	0.0
United Arab Emirates	1	0	0.0
Total/Averages	***125***	***320***	***2.6***

The final two figures—Figures 7 and 8—compare the Jihadist versus the mentally disturbed attackers for the most recent period. It is interesting to note here that, as shown in Figure 7, the frequency of Jihadist attacks rises in 2017 and 2018 and then falls, while the frequency of attacks by mentally disturbed individuals continues to rise through 2018, although it is decreasing somewhat thus far in 2019.

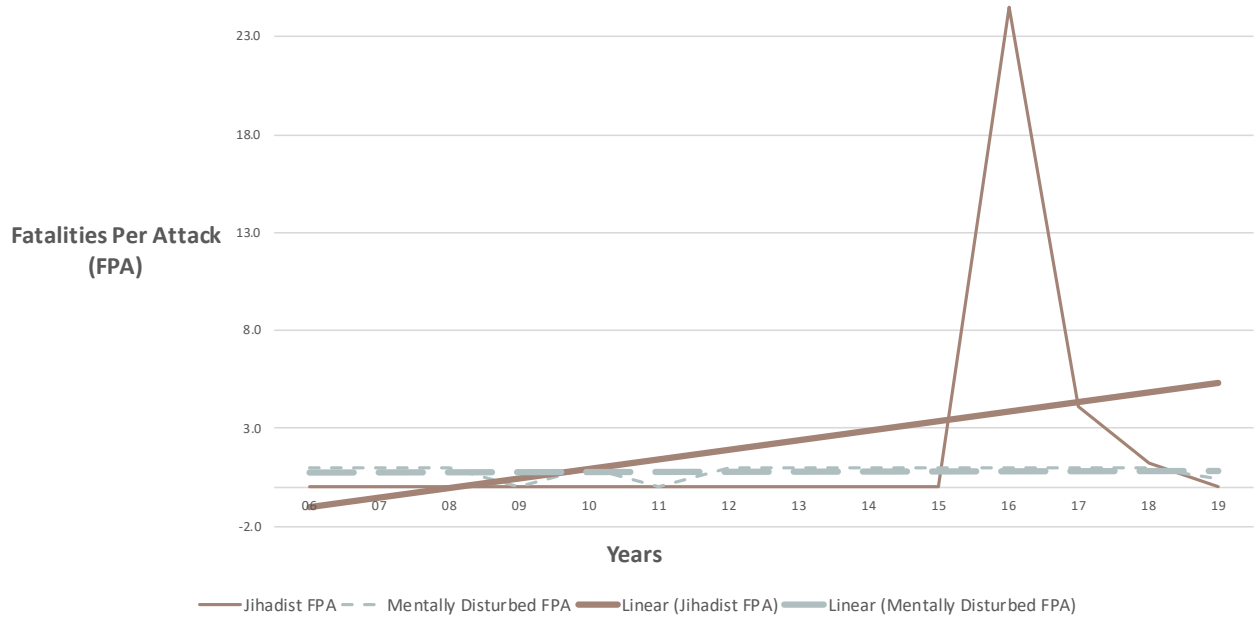

Figure 7. 2014 through 9/2019: Jihadist versus Mentally Disturbed Attacks

Figure 8 compares recent Jihadist and mentally disturbed attackers in terms of lethality. Here, we see that the lethality of Jihadist rose sharply in 2016, largely owing to the Nice attack, then falls and climbs back up. But the overall trend for this period, because of the 2016 attacks, is slightly down. The lethality of attacks by mentally disturbed individuals remains flat.

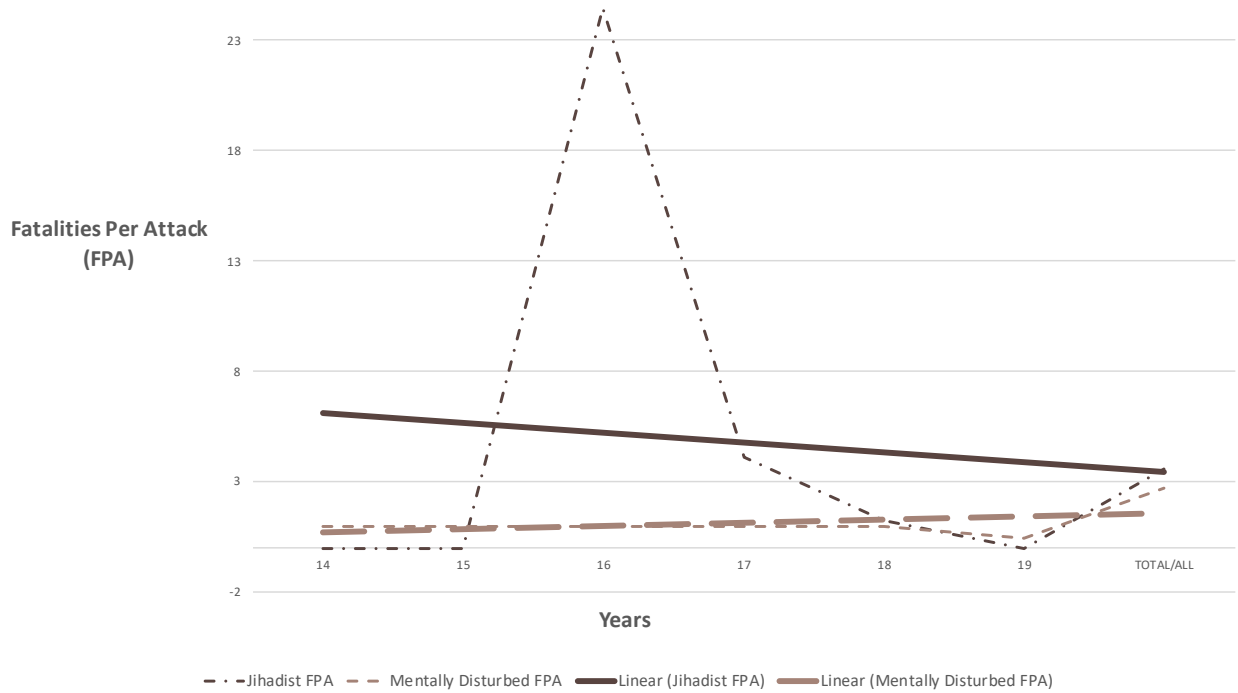

Figure 8. 2014 through 9/2019: Jihadist versus Mentally Disturbed Lethality

VIII. CONTEMPLATED COUNTERMEASURES

Modern cities allow motor vehicles and pedestrians to move in close proximity—at intersections, they are often only inches apart. New York City has nearly 2 million registered vehicles[14]—and this figure does not count the thousands of private and commercial vehicles that come into the city daily. More than 8 million people live in the city. Commuters nearly double the population of Manhattan alone from 1.6 million to 3.1 million.[15] Los Angeles County has a population of more than 10 million people and 6.5 million registered vehicles.[16] Without massive re-engineering and construction, the two cannot be separated. Vehicles are a source of continuing danger—in the United States, vehicles kill approximately 6,000 pedestrians annually.[17] Part of the explanation is that drivers and pedestrians are distracted by their phones.

This suggests that complete or substantial prevention of vehicle rammings is simply unrealistic. But mitigation is possible. Strategies to reduce casualties caused by deliberate vehicle ramming attacks include preventing attackers from renting larger vehicles capable of causing greater casualties and protecting pedestrians with various kinds of barriers.

RENTED VEHICLES USED IN DEADLIEST ATTACKS

Our data shows that just **6** attacks since 2014 (or **5%**) involved rental vehicles. However, these attacks accounted for 125, or **39%**, of the total fatalities. These attacks also had a much higher number of fatalities per incident—20.8 deaths per attack. Even excluding the 2016 attack in Nice, France, which killed 86 persons, attacks involving rental vehicles account for **39** of the deaths (or **12%**)—more than any other category other than using a personal or family car, and the deadliest category by acquisition method with an FPA of 6.5, lower only than the 7.0 FPA attained by a single vehicle hijacking. Six (33%) of the 18 Jihadist attacks that have occurred since 2014 involved rentals (4) and theft (2), far more than any other attacker group.

The United Kingdom's Department for Transport (DfT) has issued new guidance aimed at preventing terrorists from getting access to larger vehicles. Rental companies are asked to thoroughly examine credentials, insist on electronic payment (which allows quick checks on identity and other information), and promptly report suspicious renters.

Another recommended practice is to have a designated security person in every office who can examine applications that arouse suspicions and decide whether to allow the rental or notify authorities.

Theoretically, algorithms could be developed to help rental companies identify out-of-the-ordinary rentals, much like the algorithms airlines use to identify passengers meriting greater scrutiny. This could prompt cross-checking with existing databases. Such checks could focus not only on the attributes of the renter, but also on the size of the vehicle. (The Nice and Berlin attacks both involved trucks.) However, such measures raise civil liberty concerns, and they will not prevent terrorists from borrowing or stealing vehicles nor using their own.

Lawsuits by victims of vehicle ramming attacks or members of their families may oblige American rental companies to adopt more rigorous security measures.

Stolen or hijacked vehicles were used in 13 of the 125 vehicle ramming attacks since 2014. The British government has also issued guidance to trucking companies and truckers to increase the security of their vehicles against theft. The British guidelines call for thorough pre-employment checks, improving security in truck yards, CCTV, controlling access by contractors and visitors, actions by drivers to prevent vehicle theft, keeping route and scheduling information confidential, reporting suspicious behavior, and promptly reporting thefts. The prompt reporting of a truck stolen in Virginia in 2019 enabled police to prevent what could have been a devastating vehicle ramming attack.

In addition to the sensible steps outlined by British authorities, some commercial trucking fleets have remote tracking devices that enable monitoring of route deviations; remote shutdown capabilities to immobilize stolen vehicles or trucks deviating from prescribed routes could also be utilized. MTI research on the possibility of terrorists using vehicles carrying hazardous materials as weapons has explored this approach.[18]

PROTECTING PEDESTRIANS

The other broad approach is to enhance barriers between pedestrians and vehicles. The objective here is to reduce the highest-lethality attacks. The deadliest vehicle-ramming incidents occur where vehicles—particularly but not exclusively vans or trucks—mow down pedestrians at public gatherings such as open-air markets or on pedestrianized streets from which vehicles are prohibited but nevertheless can enter. Open air markets and celebrations attract crowds, and foot traffic on pedestrianized streets is usually dense. This makes these venues lucrative targets for vehicular assaults, rather like a super-sized bowling ball that doesn't lose momentum, knocking over many dozens of human bowling pins caught in a narrow alley.

Some urban planners are already pedestrianizing town centers and shopping districts for environmental and commercial reasons. In response to the Irish Republican Army's bombing campaign, British authorities created the so-called "Ring of Steel" around London's financial district. The concern here was not preventing vehicle ramming attacks, which were not part of the IRA's tactical repertoire, but rather preventing the terrorist group from getting large truck bombs into the area. Protective measures involved manned check-points where trucks were inspected before entry, restricted truck routes in and through the protected area, and the pedestrianization of a number of streets. In addition to the increased security, the reduction of vehicle traffic and enhanced environment for walking and sidewalk cafes were seen to improve the quality of life in the protected zone.

Many European cities have streets that are pedestrianized permanently or on certain days. These become promenades for shoppers and tourists. The lesson learned from the August 17, 2017 Las Ramblas attack in Barcelona, however, is that they can also become attractive targets for attackers if vehicles can easily gain access. Pedestrianized streets must be adequately protected by barriers. If vehicles are to be allowed in at times, temporary or pop-up bollards can be installed to ensure safety, and providing

barriers—even strong lamp poles and large tree pots—for pedestrians to “dodge” behind can be useful.

Temporary assemblies of people at, for example, open air markets or street celebrations, can also be protected by parking vehicles to block access to streets and plazas where street markets or other events are being held or by deploying a new and growing range of temporary anti-vehicle barriers. To protect more than 2 million people gathering to celebrate the arrival of 2019 in New York City’s Times Square, city authorities added 200 concrete blocks to the existing metal bollards that protect the square and parked 60 heavy sanitation trucks and almost 200 police cars to block intersections leading to the pedestrianized area.[19]

Security measures were in place to protect those watching the fireworks on Bastille Day in July 2016 in Nice, but a security failure allowed an unchecked cargo truck to enter the protected area—and 86 people died in the attack. Crowd-protection measures must be strictly observed if they are to be effective.

Groups of people waiting at bus stops are another potential target that can be protected by barriers. Israel has installed barriers at many bus stops.

Protecting ordinary streets on a permanent basis is a bigger challenge, although casualties resulting from vehicle ramming attacks in this venue are far fewer. Parked cars, lamp posts, and trees provide natural barriers against cars jumping the curb to attack pedestrians. Additional barriers can be installed to cover gaps. These need not be ugly concrete fortifications, but instead can be attractive planters, even statuary. Access from parked cars to the sidewalk has to be maintained. The fences between sidewalks and streets that now prevent jaywalking or street crossings at dangerous intersections could be strengthened and expanded.

The threat of terrorist truck bombs has already resulted in road closures and the installation of barriers around government buildings. These measures could be expanded, widening the security circle. A more ambitious measure to protect against vehicular attacks would entail surrounding entire portions of cities with surveillance systems and physical barriers.

More armed police could be deployed to increase surveillance and enable faster response to an attack. However, the time for a moving car or truck to suddenly veer into pedestrians is a matter of seconds—a vehicle traveling 30 miles an hour can travel 660 feet, a standard city block, in 15 seconds. Rapid response is good, but it cannot prevent carnage. There has been some discussion of allowing police to fire into a ramming vehicle – Washington DC, New York and Chicago and revised their guidelines -- a tactic previously not permitted because of the risk to innocent life.

With the promise of autonomous vehicles, software can be developed to prevent them from ramming into pedestrians. Autonomous vehicles (AVs), however, will create other vulnerabilities.

These are ideas discussed, and not a catalog of practical or proven countermeasures. More

analysis is required to determine whether these potential countermeasures to vehicular terrorism would be effective, to identify other countermeasures, and to examine their costs and potential consequences. This work does not preclude a discussion of whether the potential results merit the disruption and investment such measures would entail.

APPENDIX A: RECENT PUBLICATIONS ON VEHICLE RAMMING ATTACKS

Clarke, Colin, “The Continuing Plague of Vehicle Attacks: What Can Be Done?” *The Globe and Mail,* April 25, 2018. https://www.theglobeandmail.com/opinion/article-the-continuing-plague-of-vehicle-attacks-what-can-be-done/

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4. Yahya Ibahim, "The Ultimate Mowing Machine," *Inspire* 2 (October 2010).

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6. "In a public statement by ISIS leader Abu Bakr al Baghdadi, the first in a year, he calls on his supporters to carry out terrorist attacks worldwide, mainly in Western countries. He mentions shooting, stabbing and ramming attacks as well as detonation of IEDs," The Meir Amit Intelligence and Terrorism Information Center, August 27, 2018, https://www.terrorism-info.org.il/en/microsoft-wordin-public-statement-isis-leader-abu-bakr-al-baghdadi-first-year-calls-supporters-carry-terrorist-attacks-worldwide-mainly-western-countries-ment/.

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