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Terrorist Vehicle Attacks on Public Surface Transportation Targets

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As the recent terrorist attacks in Barcelona and Cambrils Spain attest, using vehicles as a readily available means to mow down pedestrians is a growing trend.

And it is a frightening one. It involves turning an easily-acquired vehicle into a weapon to kill or maim in places where citizens presume they are safe. No firearms have to be acquired or bombs made. That is no doubt why vehicle rammings, along with knife assaults, are being advocated by jihadist organizations like ISIS and al Qaeda. Attacks can be done quickly and with little preparation, which decreases the possibility of discovery and intervention by security authorities before the attack.

Since January 2015, there have been ten such vehicular assaults. Prior to the attacks in Spain, similar assaults occurred in France, Germany, Sweden, Austria, Belgium, Israel, the Palestinian territories, the United Kingdom, and the United States. This type of vehicular assaults can occur at public surface transportation locations such as bus stops or train stations. However, the data suggests that, so far, vehicle rammings are not as lethal as might be thought, and have not been used as often as one might expect against public transportation targets. This possibly could be because major train and bus terminals, and even bus stops in countries that have experienced these attacks, can be protected by bollards and additional police or military presence.

This preliminary inquiry reviews vehicle attacks on public surface transportation between January 1, 1970 and September 1, 2017. Just under half of these cases involve suicide drivers ramming vehicles packed with explosives (Vehicle-Borne Improvised Explosive Devices or VBIEDs) into their targets – a more complex operation to pull off. We refer to these as

"suicide VBIED rammings" or SVRs. In the other cases, the vehicle itself was the weapon. These latter attacks are referred to as "vehicle rammings" or VRs. Figure 1 presents a breakdown of vehicle attacks by type.

The term "vehicle" is used generically here, and includes automobiles, trucks, in three cases construction or industrial equipment (a bulldozer, a backhoe, and an excavator), as well as motorcycles, and in one case a bicycle packed with explosives.

Although recently on an upward trend, the 37 vehicle attacks on surface transportation targets represent less than one percent of the total number of the total number of 5,275 attacks on surface transportation targets during the period examined. The 18 suicide VBIED rammings and 19 vehicle rammings resulted a total of 247 fatalities, which represents about two percent of all fatalities caused by attacks on surface transportation during the same period. All but 24 of the fatalities resulted from the attacks with explosives. In addition to the deaths, the 37 attacks caused 594 injuries.

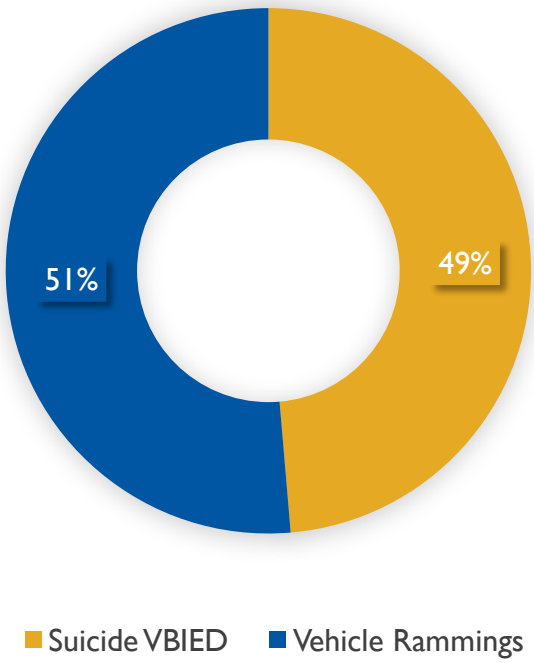

Figure 1: Vehicle Attacks by Type, 1970 - 2017

Numbers of Attacks

The trends for the two types of attack are somewhat similar. For vehicle rammings, 14 of the 19 attacks occurred between 2014 and 2017, with one attack happening in each of the following preceding years: 1996, 1999, 2001, and two occurring in 2008. For suicide VBIED rammings 10 of the 18 attacks occurred between 2013 and 2015 (but, interestingly, with none in 2016 and so far, none in 2017). There was also one attack each for the following preceding years: 1994, 1998, 2000, 2002, and three attacks in 2009. Figure 2 shows the number of attacks for both methods since 1970.

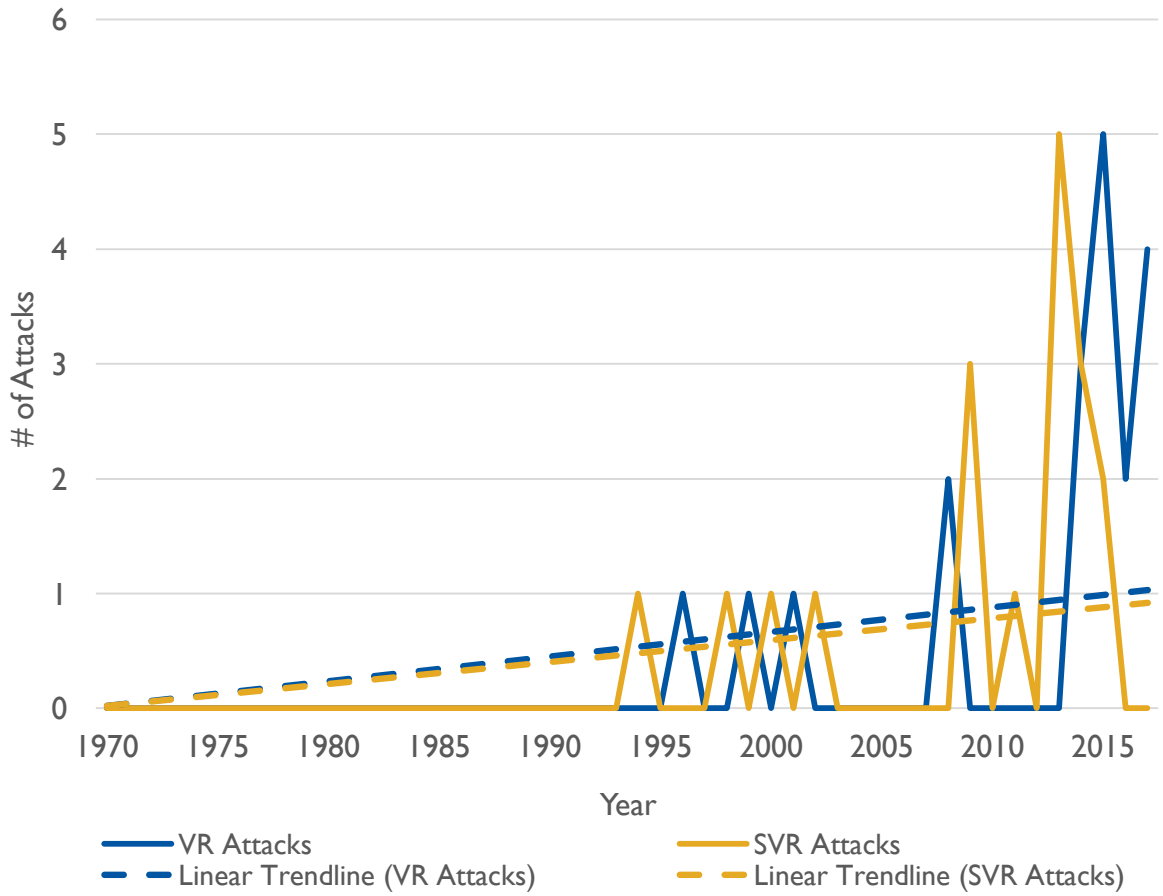

Figure 2: Attacks over Time: Vehicle Rammings and Suicide VBIED Rammings

Lethality

In terms of lethality, the two attack methods differ, especially in absolute terms. The suicide VBIED rammings account for 223 (or 90 percent) of the 247 deaths. In terms of average fatalities per attack (FPA), suicide VBIED rammings are the second most lethal attack method, achieving an average FPA of 12.4 (the median FPA is 8.0). Only multiple weapon attacks involving train derailments followed by armed assaults, with an average FPA of 24.5 (and a median FPA of 1.5) are more lethal.

Vehicle rammings, by contrast, are the 21st most lethal tactic, with an average FPA of 1.3, considerably lower than the average for all attacks on surface transportation (2.3), but a median FPA of 1.0, higher than the median for all attacks (0.0). Separate research shows that vehicle rammings directed against all target categories, including those directed against surface transportation targets, achieve an FPA of about 4 persons per attack, but this includes the

devastating attack in Nice France, which killed 84 people. Leaving this outlier aside, the average FPA for the remaining vehicle rammings against all targets is about 2.1.[1]

Over time, fatalities per attack in vehicle rammings increased slightly, though the fatalities still were very low. An average FPA of 1.0 or more was reached starting in 1996, with the highest average FPA of 8.0 achieved in 2001. For suicide VBIED rammings, however, the increase in lethality was greater, with an average FPA of 2.0 first reached in 1998, and a peak average of 26.1 fatalities per attack for the 5 attacks that took place in 2013. Figure 3 shows the increase in lethality for both attack methods since 1970.

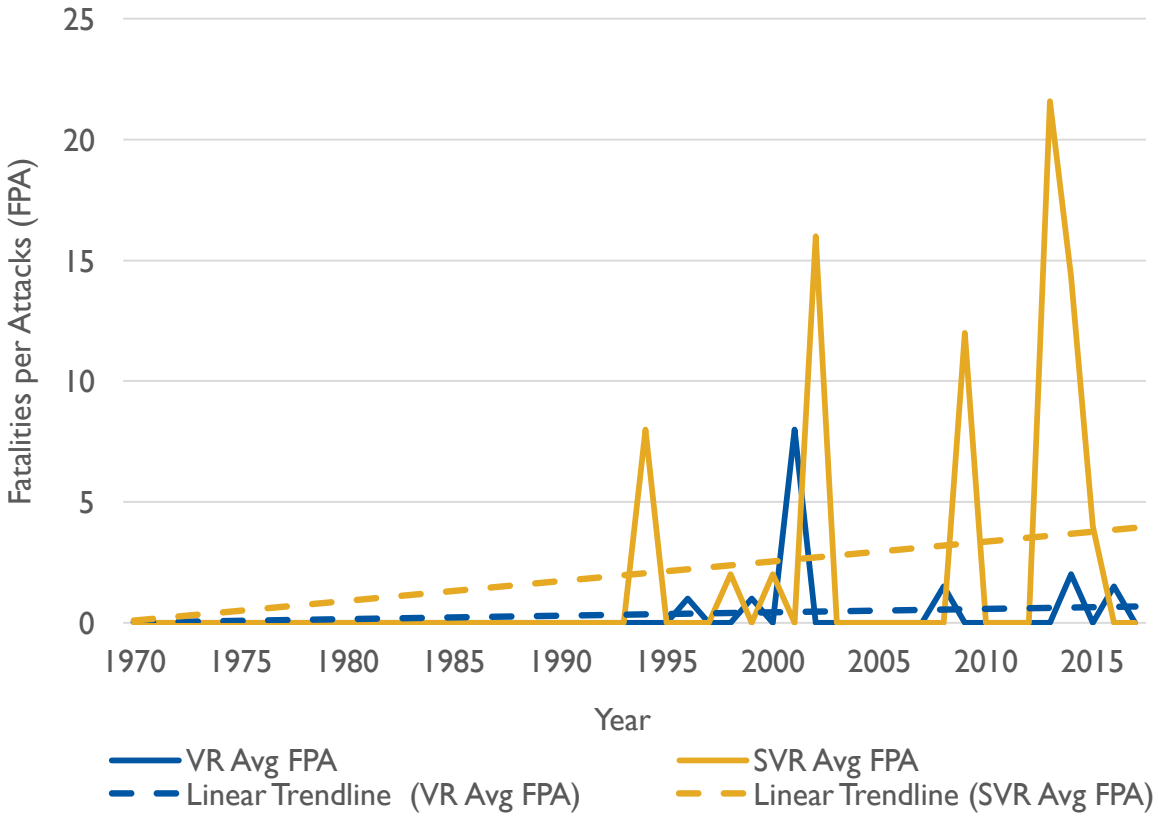

Figure 3: Average Fatalities Per Attack (FPA) Over Time: Vehicle Rammings and Suicide VBIED Rammings

In terms of the median as opposed to average number of fatalities per attack, the picture is pretty much the same. Suicide VBIED rammings are the third most lethal tactic with a median FPA of 8.0 with only executions[2] (9.0) and claymore mines (9.5) being higher. As for vehicle rammings, the median FPA is 1.0.

[1] Brian Michael Jenkins, "Terrorists can use cars, trucks and vans to kill their targets. What's the best way to keep people safe," *Fox News Opinion,* September 13, 2017. http://www.foxnews.com/opinion/2017/09/03/brian-jenkins-terrorists-can-use-cars-trucks-and-vans-to-kill-their-targets-whats-best-way-to-keep-people-safe.html.

[2] The MTI database classifies as "executions" those incidents where attackers take people off of a bus or train and murder them execution-style.

Vehicles Employed in the Attacks

As mentioned, the term vehicle is not limited to automobiles, although those are the vehicle type most commonly used. In vehicle rammings, 15 of the 19 attacks involved automobiles, while three attacks involved construction equipment (a bulldozer, a backhoe, and an excavator) and one attack involved a bus. Not surprisingly, the attack using a bus caused the highest number of fatalities (8), and the bulldozer the second (killing 3).

In suicide VBIED rammings, 12 of the 18 attacks involved automobiles (or "vehicles" assumed to be automobiles), 5 involved motorcycles, and one involved a bicycle. Explosives-packed automobiles proved the most lethal with 16.9 deaths per attack. Attacks involving motorcycles carrying explosives caused 3.6 fatalities per attack. The lone bicycle attack killed two persons.

Suicides

All of the suicide VBIED rammings were driven by suicide drivers. (It is presumed no one intended to survive if they detonated the vehicle while being in it.) The vehicle rammings are not considered suicides because we cannot assume that the attacker intended to die. A close examination of each of the vehicle ramming cases might reveal suicidal intention for some of the attacks, but for now we find that in no case is there a record of the attacker subsequently attempting to detonate an explosive device or even use a knife, and in 5 cases the driver drove off or attempted to run away after the attack. (However, several of the vehicle ramming cases against targets other than transportation did involve attackers following up the ramming with a stabbing attack.) This contrasts with the vehicle assaults on non-surface transportation targets where in some of the cases, the terrorist drivers emerged from the vehicle and attempted to continue the attack.

Targets

In the vehicle ramming attacks, all but two of the targets were related to buses. There were 13 attacks against bus stops, killing only 7 (for an average lethality of 0.5), while 4 attacks against scheduled buses killed 12, for an average lethality of 3.0. There were also two attacks on passengers at light rail stops in Israel, killing 5 for an average lethality of 2.5

For suicide VBIED rammings, all but one was against bus targets, the exception being an attack against a convoy. Nine attacks were against scheduled buses, with an average FPA of 9.9, and 4 were against open-air bus stations, yielding a much higher FPA of 19.0. There was one attack each against a bus stop yielding the highest FPA (30), and then one each against a school bus, a charter bus, a government or company bus, and against a convoy, with fatalities of between 12 (for the convoy) and 2 (for the school bus).

Countries and Attackers

All but the most recent of the vehicle rammings took place in Israel or the Palestinian Territories and were directed primarily against bus stops, where Israeli soldiers can frequently be seen waiting, plus two against passengers near light rail stations. One attack (involving the backhoe) was carried out by a mentally disordered person (as was, coincidentally, the recent August 2017 incident in Marseille, France). All the other attacks in Israel or the Palestinian

Territories were carried out by individual Palestinian extremists, although HAMAS claimed two attacks and was suspected of involvement in another.

The picture is different for suicide VBIED rammings. While six of the 18 attacks took place in Nigeria (3) and Israel (3), the remaining attacks took place in the countries where there have been numerous attacks on surface transportation: 7 in Pakistan, 3 in Iraq, and 1 each in Somalia and Sri Lanka. Attacks in Iraq had the highest lethality—19.7. Attacks by Boko Haram in Nigeria had an average lethality per attack of 16.3. The three attacks in Israel yielded an average FPA of 8.7. Two persons died in the attack in Sri Lanka.

Of the 18 suicide VBIED rammings, 7 were carried out by jihadists, and 11 by various guerilla or terrorist groups. The highest lethality was not that of jihadists (8.0) but by other guerilla or terrorist groups (11.4).

The seven jihadist attacks were concentrated in Nigeria where Boko Haram carried out 3 attacks, and Pakistan with two attacks, one by Lashkar-e-Jhangvi and one by the Taliban. Al-Shabab carried out a single attack in Somalia. The eleven attacks by other guerrilla or terrorist groups were carried out by HAMAS in Israel (3 attacks), and by unknown militant groups in Pakistan (4) Iraq (3), and Sri Lanka (1).

Assessing the Future Threat

Vehicle rammings, with or without explosives, directed against public surface transportation targets are, of course, a concern that attracts a great deal of public attention now. But *so far,* they have occurred rarely and mainly in countries already experiencing on-going insurgencies or terrorist campaigns. For example, all of the suicide VBIED rammings have occurred in conflict zones (Pakistan, Iraq, Nigeria, Somalia, Sri Lanka) or in Israel, and all but one of the vehicle rammings have occurred in Israel or the Palestinian territories. And although the number of vehicle attacks has increased, with 19 of the 37 attacks occurring since 2014, and the lethality of the two attack methods combined has also increased, the increase is not particularly dramatic.

Of course, VBIEDs are always a dangerous form of attack, whether directed against transportation or other targets. Vehicle rammings not involving explosives have increased recently and represent a clear trend. And they are occurring in Europe, North America, and Australia. (The original intentions of the terrorists in the recent Barcelona attack are still not clear—the vehicle attack, which killed 17 people, appears to have been a hastily concocted Plan B when an accidental explosion alerted authorities to a terrorist bomb factory. One possibility was a vehicle ramming accompanied or followed by an explosion). Authorities must be aware of the possibility that a vehicle used in a ramming attack may contain explosives to be detonated in a second-phase attack.

The most recent vehicle ramming attacks, however, have been directed primarily against pedestrians, not necessarily transportation targets. A comparison of the body counts in vehicle ramming attacks on all targets compared to those directed against public surface transportation targets shows no advantage in attacking public surface transportation targets. One can anticipate more ramming attacks, but not necessarily against transportation targets, except perhaps where passengers are more out in the open – such as at bus stops.

Overall, governmental and transportation authorities will need to continue to assess these attack methods and consider what countermeasures (such as, but not limited to, bollards) can be reasonable and effective.

About MTI

At the Mineta Transportation Institute (MTI) at San Jose State University (SJSU) our mission is to increase mobility for all by improving the safety, efficiency, accessibility, and convenience of our nation's transportation system through research, education, workforce development and technology transfer. We help create a connected world. MTI was founded in 1991 and is funded through the US Departments of Transportation and Homeland Security, the California Department of Transportation, and public and private grants. MTI is affiliated with SJSU's Lucas College and Graduate School of Business.