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The Use of Explosive Devices in Attacks on Public Surface Transportation: Trends in Frequency, Lethality and Prevention

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The use of explosive devices in attacks is not new, but the devices have become deadlier and easier to use. In 1605, Guy Fawkes tried to blow up the British House of Lords with gunpowder but failed, and in 1881, dynamite was successfully used to kill a Russian tsar. Bombs have been combined with vehicles with devastating effects. In 1920, a horse-drawn cart loaded with explosives and metal parts exploded on Wall Street, killing 20 people. Vehicle-borne devices killed 240 U.S. Marines and 55 French paratroopers in Beirut in 1983 and have also been used against U.S. embassies. Suicide bombings, including the attack on the London subway system on July 7, 2005, which killed 52 people and injured 700, remain a deadly terrorist tactic. By the end of the 20th century, bombings of all kinds were the terrorist weapon of choice.

In 2022, MTI examined attacks against public surface transportation in countries with developing economies,[1] and in 2023, it examined the same types of attacks against countries with developing economies.[2] This study examines the ways bombs were used in such attacks—their number, their placement, their frequency and lethality, and how often they were detected before being detonated.

Study Methods

The study is based on data in the MTI Database on Terrorism and Serious Criminal Attacks Against Public Surface Transportation, along with a wealth of qualitative information held by the authors.

The attacks studied were selected by time, target, and type. They occurred between January 1, 2004, and December 31, 2021. The targets were passenger train and train stations, buses and bus stations and stops, passenger ferries and terminals, rail infrastructure, and operating and security staff. Earlier attacks on which data are less complete were not included. The attackers used bombs alone or in combination with other methods.

As was done in earlier MTI reports, the researchers divided the target countries into groups. The economically advanced countries, defined as members of the Organisation for Economic Cooperation and Development (OECD), with the exclusion of some members that have long-standing insurgencies, are called Group 1. Non-economically advanced countries are called Group 2. Israel and the Palestinian Territories, Group 3, are not included in this analysis because of their unique and long-standing conflict. (This group will be analyzed in a subsequent report.)

Key Findings

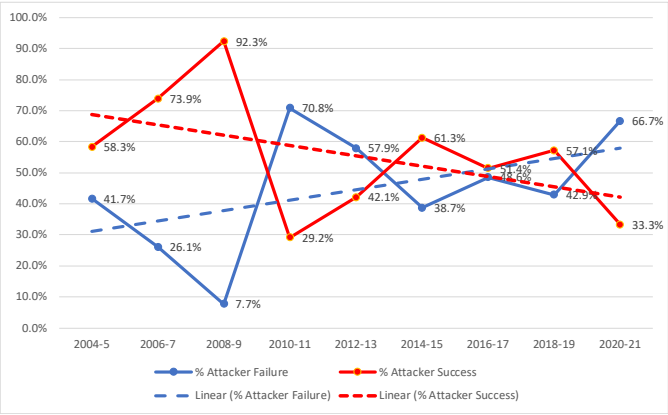
- Explosives were used in the majority of attacks on surface transportation, and bombing attacks resulted in the majority of fatalities and injuries.
- The MTI database records 3,836 attacks on surface transportation that occurred between January 1, 2004, and December 31, 2021. The attacks killed 7,412 people and injured 21,847, an average of 1.9 fatalities and 5.7 injuries per attack.
- Bombs, sometimes in combination with other methods, were used in the majority of these attacks (57%). Attacks with explosives accounted for 4,674 (63%) of the 7,412 fatalities and 16,666 (76%) of the 21,847 injuries, resulting

1 Brian Michael Jenkins and Bruce R. Butterworth, *Changing Patterns of Violence Pose New Challenges to Public Surface Transportation in the United States*, Mineta Transportation Institute, August 2022.

2 Brian Michael Jenkins, Bruce R. Butterworth, and Sachi Yagyu, *Evolving Patterns of Violence in Developing Countries*, Mineta Transportation Institute, August 2023.

in an FPA (fatalities per attack) of 2.3 and an IPA (injuries per attack) of 8.3, which was higher than the overall average of 1.9 FPA and 5.7 IPA.

- Bombs were used more frequently in attacks in less-developed countries than in countries with more-developed economies.
- While the percentage of bomb attacks in both groups of countries has decreased, their lethality has increased.
- In economically advanced countries, bombs are most frequently placed inside bus or train compartments, on railway tracks, or inside train stations. Suicide bombings are the most lethal attack method, followed by bombs placed in passenger compartments. Bombs on railway tracks are designed for disruption, not for death.
- In less-developed countries, placement is most often on railway tracks, in passenger compartments, or at stations or stops. Vehicle-borne improvised explosive devices (VBIEDs)—both suicide and non-suicide—are the most lethal attack method, followed by suicide attackers carrying bombs. Bombs placed on railway tracks are aimed at disruption and have low lethality.
- In economically advanced countries, the majority of attacks were unsuccessful, with devices discovered, malfunctioning, or failing to detonate. Although bomber success is decreasing, bombs, particularly in confined spaces, remain very lethal.



Bomber Success in Economically Advanced Countries

- In less-developed countries, a higher percentage of bombs detonated on time and on target, and fewer were found by authorities. This may be because explosives are easier to acquire in these countries or detection and prevention are weaker.
- Worldwide, successful bombings have declined, although there is little change in the percentage of devices that fail to go off as planned. More bombs are detected, particularly in economically advanced countries.
- The identity of people who stopped attacks or found bombs is "unknown" in nearly half of the attacks, a percentage that has not changed in economically advanced countries but has increased in the others. Of the devices that were found before detonating in the economically advanced countries, 40% were found by passengers, citizens, or employees; in the other countries, that group was responsible for finding the devices in only 21% of the failed attacks. The difference is reversed for security, police, and military officials.

About the Authors

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To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2369

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