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Frequency and Lethality of Attacks on Surface Transportation Systems of Developed Countries, by Time of Day

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Top Level Summary

Transit operators, security officials, and indeed, passengers often ask what time of day most attacks on passenger train and bus systems in modern developed countries occur and when they kill the most people. The authors have answered these questions. Attacks by different types of attackers are actually not concentrated at peak hours. And, averaged over 51 years, the lethality of such attacks in developed countries is not that great – the average is 0.4 deaths per attack. But deaths and deaths per attack (lethality) are the greatest during holiday peaks and also during weekday peak hours – particularly during the peak morning hours. This is particularly true if we include the four weekday attacks that killed the most people: the 1995 Tokyo Sarin attack; the 2003 Daegu, South Korea, suicide arson attack; and the 2004 and 2005 jihadist attacks in Madrid and London. Figures 1 and 2 above show the distribution of deaths during weekday rush hour time blocks with and without these events included, and Figures 3 and 4 show lethality with and without those events.

Study Methods

The authors used the MTI database of Terrorist and Serious Criminal Attacks Against Public Surface Transportation. They carefully reviewed all the attacks that occurred in the 51 years between 1970 and 2020 and selected those against passenger trains and train stations and buses and bus stations or stops (and some associated targets) in more-developed modern countries such as the United States, Australia, Japan, and EU member states. There were 504 such attacks.

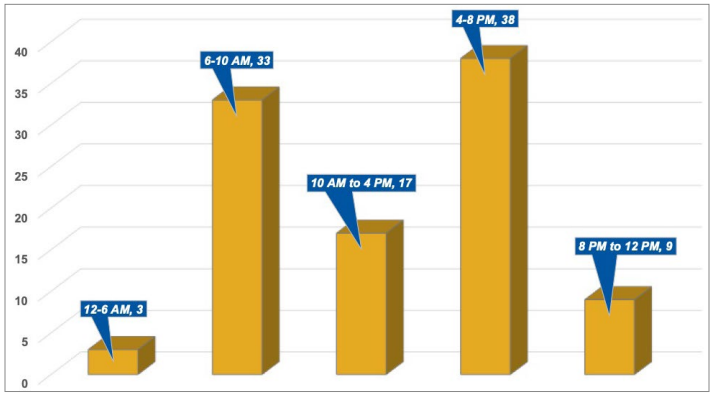

Figure 1. Weekday Deaths

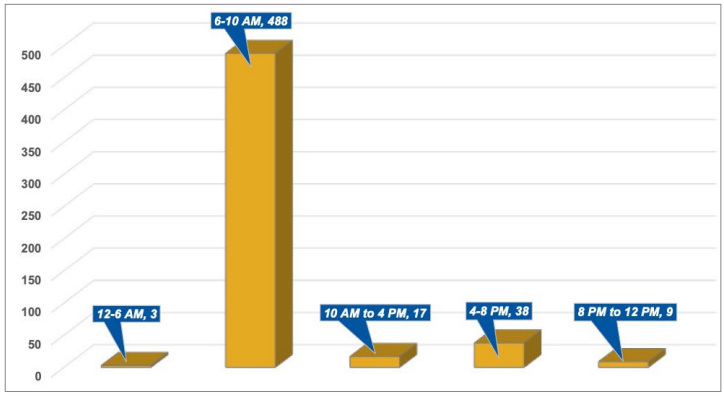

Figure 2. Weekday Deaths - 4 Major Attacks Added

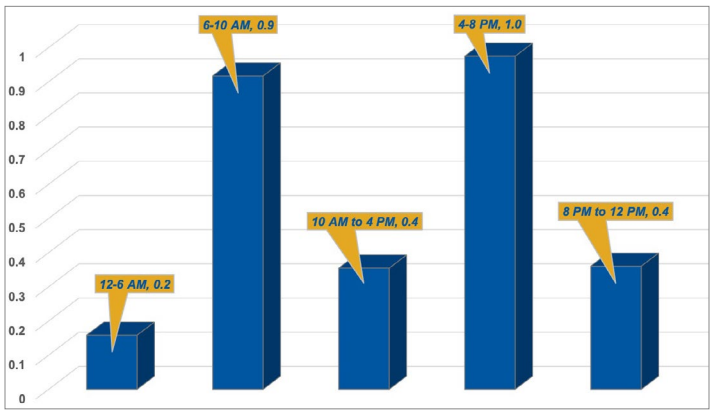

Figure 3. Weekday Lethality

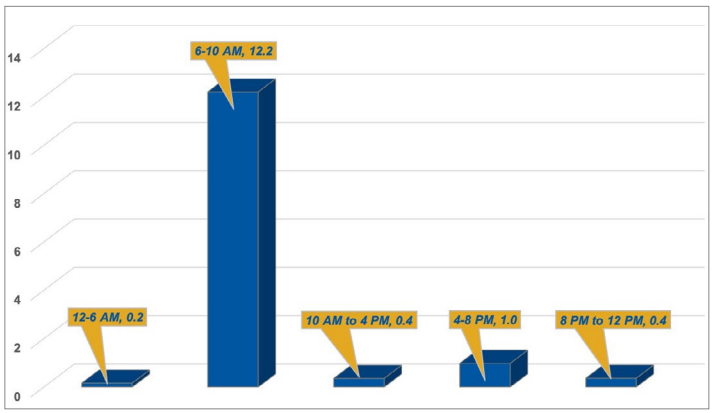

Figure 4. Weekday Lethality - 4 Major Attacks Added

Findings

An analysis of 504 attacks on passenger rail and bus systems in economically advanced countries shows that, overall, more attacks occur during non-peak traffic hours than during peak hours: 63% of the attacks occurred in off-peak hours, and only 19% occurred during peak hours. The timing of the remaining 19% of attacks is unknown. It is important to note that these figures are for all of the attacks.

If we consider only the 168 weekday attacks for which the specific time is known or can be estimated (the time of six of the weekday attacks is not known), the proportions shift significantly: 45% take place in peak periods, and 55% take place in off-peak periods.

Far more importantly, attacks occurring during peak hours cause significantly more deaths than attacks in off-peak hours. Consequently, while the overall lethality of all attacks is low, 0.4 fatalities per attack (FPA), the lethality of peak hour attacks is 0.9 FPA, which is 4.5 times higher than the 0.2 FPA of non-peak attacks.

This difference in lethality is not simply the result of a handful of large-scale incidents driving the numbers. Mindful of the possible distortion that would result from including such attacks, the authors omitted the four deadliest attacks from their overall analysis: the 1995 Tokyo Sarin attack, which killed 12 persons and injured 5,000; the 2003 arson attack on a subway in Daegu, South Korea, which killed 198; the 2004 bombing of commuter trains in Madrid, which killed 193; and the 2005 bombing of transportation targets in London, which killed 52.

When those four attacks are included in the calculations, the differences in lethality between peak hour and non-peak hour attacks are even greater, in particular, the lethality of attacks in the morning rush hour, when all four occurred. Their combined death toll of 455 increases the lethality

of all weekday attacks by more than 5 times, from 0.6 deaths per attack to 3.2 deaths per attack, and increases the lethality of all morning rush hour attacks by more than 13 times, from 0.9 deaths per attack to 12.2 deaths per attack. Inclusion of the Tokyo Sarin attack also increases the injuries per attack exponentially.

The morning rush hour may be the most lethal time of attacks on surface transportation because it offers a large number of potential victims, important particularly when bombs are used. Moreover, attackers may be able to avoid detection in morning crowds, and the night and early morning hours offer a long period when last-minute operations can be readied under minimal surveillance.

Terrorists time their attacks to occur not only during weekday rush hours, but also during peak travel times associated with holidays and vacation travel. The most dramatic example of this is the 1980 bombing of the Bologna train station on the first Saturday of the Italian vacation season, in which 85 people were killed. Including the Bologna attack increases the lethality of holiday peak attacks – already high at 4.4 FPA – by more than 2.5 times, to 11.7 FPA.

The correlation between attacks and peak traffic times reflects the determination of terrorists to cause maximum disruption or achieve high body counts. Right-wing extremists and jihadists are the most lethal attackers, even without consideration of the outlier events.

Some attackers – left-wing groups and Basque separatists, for example – have avoided large-scale casualties and generally have carried out their attacks during off-peak hours, often at night to avoid detection. Although the Provisional Wing of the Irish Republican Army (PIRA) was capable of carrying out deadly attacks, PIRA bombings of transportation systems, especially in the 1970s, were aimed primarily at disruption.

The pattern of attacks on train targets is quite different from that of attacks on bus targets, with more bus attacks occurring during non-peak hours; however, similar to weekday train attacks, almost all fatalities in weekday bus attacks occur in the peak traffic hours. In contrast to train attacks, attacks on bus targets in the afternoon rush hour are more lethal than those in the morning rush hour.

These findings should be useful to those responsible for running and overseeing transit operations, visible and remote security presence, and quick response to attacks on transit systems.

About the Authors

Brian Michael Jenkins is the director of the Mineta Transportation Institute's Allied Telesis National Transportation Security Center and, since 1997, has directed the Institute's continuing research on protecting surface transportation against terrorism and other serious forms of crime.

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To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/SP0521

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