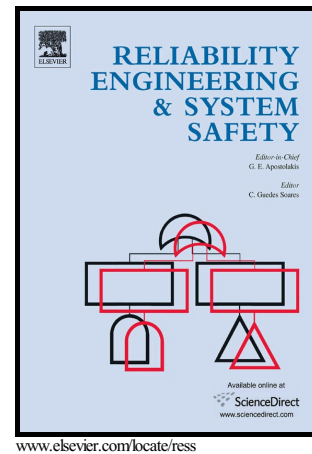


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Modelling Improvised Explosive Device Attacks in the West – Assessing the Hazard

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ABSTRACT

Improvised Explosive Devices (IEDs) continue to be a terrorist weapon of choice. With increasing pressures on the economies of Western nations, spending on counter-terrorism is subject to greater scrutiny. Homeland security agencies are no longer exempt from government fiscal due diligence, needing to justify how their spending achieves best value-for-money. Probabilistic Risk Assessment (PRA) is a valuable tool that can assist in this endeavour. This paper introduces a PRA model that characterises IED attacks in Western nations, and can be used to assess the risk reduction associated with IED attack countermeasures. When using the model with the START open-source terrorism database we identified that current IED attack countermeasures provide a risk reduction of at approximately 22%, and that terrorists using IEDs in Western nations cannot generally be considered adaptive, with the operational effectiveness of terrorists being approximately 7%.

1. INTRODUCTION

Terrorist threats against civilian and military infrastructure are a concern to the public and government. Improvised Explosive Devices (IEDs) continue to be a terrorist weapon of choice, with homeland security agencies implementing counter-terrorism strategies and technologies to combat threats to citizens and property. Many of these strategies are based upon vulnerability assessments for IED Attacks, assessments that are traditionally reliant upon expert opinion, assuming that an IED will successfully explode and subsequently will reach maximum theoretical explosive yield. As discussed by Cox (2008), these types of assessments can produce misleading risk estimates and poor risk management recommendations. Cox (2008) identified that treating attackers as intelligent opportunists and focusing on optimising defenses is a preferred approach to the problem of analysing risk for terrorist attack. Addition of the behavioural dimension associated with terror attacks to Probabilistic Risk Assessment (PRA) modelling, such as using Decision Analysis and Game Theory, has been the subject of significant research (eg. Paté-Cornell and Guikema 2002, Hausken 2002, Patterson and Apostolakis 2007, Sandler and Siqueira 2009, Brandt and Sandler 2010, Zhuang and Bier 2011, Sandler 2011, Hausken 2016, Hausken and He 2016). However, these approaches largely continue to rely upon expert opinions (eg. to support ranking systems) or assume that terrorists are rational adversaries. We propose an alternate approach to assess the case of IED Attack, leveraging from traditional systems and reliability engineering techniques that have successfully demonstrated utility for assessing other man-made and natural hazards (eg. Stewart and Melchers 1997, Stewart 2010a).

Despite being conceptually simple devices to design and manufacture, IED performance is highly uncertain. IEDs are typically ‘home made’ and placed under imperfect conditions, causing the potential for failure, as evidenced in numerous failed attempts between 2001 to 2014. Indeed, since 9/11, only one attack consisting of two explosions has caused fatalities in the United States (Boston 2013). Similarly, in the United Kingdom (excepting Northern Ireland), only the 7/7 bombings in London in 2005 have resulted in fatalities (Mueller and Stewart 2011, 2016). More

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