Cost benefits provided to critical infrastructure protection by high fidelity modeling and simulation – a case study

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Abstract:

Public-private partnerships (PPP, 3P, P3) are often-used vehicles for governments to accomplish large infrastructure projects, such as major bridges, with little up-front spending of public funds. In the United States, major bridges are vital systems classified by the Department of Homeland Security as critical infrastructure, and so must be protected against failure caused by terrorism events. Done smartly, incorporating physical security measures into the design of large bridges offers substantial opportunity for cost savings. Owners or stakeholders may define prescriptive protection measures, the simplest of which involve increased standoff around critical bridge components. Increase standoff equates to increased material and labor costs during construction, and increased maintenance volumes over the long term, both of which are detrimental to the financial models adopted by private entities constructing and operating these bridges. Adopting a performance-based design approach to resist terrorist threats, supported by high fidelity computational modeling, can offer significant cost savings in both construction and operation through the informed (as opposed to prescribed) use of hardening measures where needed. By this approach, large cost savings can be achieved for modest design fees. This paper presents a case study that demonstrates these benefits, highlighting that physical security design is not a tax on large infrastructure. The case study focuses on the hardening of a cable-stayed bridge tower against a large explosive threat. High fidelity calculations performed for this effort were validated with scaled explosive testing, which will also be presented in this paper.