



Risk Management Series

Reference Manual

to Mitigate Potential Terrorist Attacks Against Buildings

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FEMA

RISK MANAGEMENT SERIES

Reference Manual *to*
Mitigate Potential Terrorist
Attacks Against Buildings

PROVIDING PROTECTION TO PEOPLE AND BUILDINGS



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The creation of the Department of Homeland Security (DHS) is one of the most significant transformations in the Federal Government in decades, establishing a department whose first priority is to protect the nation against terrorist attacks. Within the DHS, the Directorate of Emergency Preparedness and Response (EP&R) is focused on ensuring that our nation is prepared for catastrophes, including both natural disasters and terrorist assaults.

Central to this mission is the protection of people and the critical infrastructure of the built environment. This Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings provides guidance to the building science community of architects and engineers, to reduce physical damage to buildings, related infrastructure, and people caused by terrorist assaults.

The comprehensive approach to understanding how to improve security in high occupancy buildings will better protect the nation from potential threats by identifying key actions and design criteria to strengthen our buildings from the forces that might be anticipated in a terrorist assault. It is important to note that many of the methodologies in this publication have been adapted from other government sources and modified to meet the mission of the DHS. This allows for the effective transfer of decades of federal and Department of Defense research and experience to the broader building science community.

This document was prepared by the Building Sciences and Technology Branch of the Mitigation Division, part of EP&R. The DHS would like to thank the following agencies for their contribution and input to this publication:

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FOREWORD AND ACKNOWLEDGMENTS

BACKGROUND

The Federal Emergency Management Agency (FEMA) developed this *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings* to provide needed information on how to mitigate the effects of potential terrorist attacks. The intended audience includes the building sciences community of architects and engineers working for private institutions, and state and local government officials working in the building sciences community. The manual supports FEMA's Mission (Lead America to prepare for, prevent, respond to, and recover from disasters) and the Strategic Plan's Goal 3 (Prepare the Nation to address the consequences of terrorism), all of which will be done within the all-hazards framework and the needs of Homeland Security.

The building science community, as a result of FEMA's efforts, has incorporated extensive building science into designing and constructing buildings against natural hazards (earthquake, fire, flood, and wind). To date, the same level of understanding has not been applied to manmade hazards (terrorism/intentional acts) and technological hazards (accidental events). Since September 11, 2001, terrorism has become a dominant domestic concern. Security can no longer be viewed as a standalone capability that can be purchased as an afterthought and then put in place. Life, safety, and security issues must become a design goal from the beginning.

OBJECTIVE AND SCOPE

The objective of this manual is to reduce physical damage to structural and non-structural components of buildings and related infrastructure, and also to reduce resultant casualties during conventional bomb attacks, as well as attacks using chemical, biological, and radiological (CBR) agents. Although the process is general in nature and applies to most building uses, this manual is most applicable for six specific types of facilities:

- Commercial office facilities
- Retail commercial facilities
- Light industrial and manufacturing facilities

- Health care facilities
- Local schools (K-12), and
- Higher education (university) facilities

The processes and measures may not generally be economical or applicable to lighter density occupancies, such as single-family homes. More intense occupancies (e.g., industrial facilities) have already been addressed in most cases.

This is one of a series of publications that address security issues in high-population, private sector buildings. This document is the foundation of the *Building Vulnerability Design Against Terrorist Attacks Training Course* (FEMA 438).

The purpose of this manual is to provide guidance to the building sciences community working for private institutions. It presents tools to help decision-makers assess the performance of their buildings against terrorist threats and to rank recommendations. It is up to the decision-makers to decide which types of threats they wish to protect against and to determine their level of risk to each threat. Those decision-makers who consider their buildings to be at high risk can use this guidance as necessary.

The information contained in this document is:

- not mandatory
- not applicable to all buildings
- not applicable when it interferes with other hazards such as fire

This manual presents incremental approaches that can be implemented over time to decrease the vulnerability of buildings to terrorist threats. Many of the recommendations can be implemented quickly and cost-effectively.

ASSUMPTIONS

The information provided herein builds upon the synergies between the mitigation measures for natural hazards and man-made hazards. For example, seismic standards for non-structural building components are beneficial against the explosive blast of conventional bombs. Hurricane window design, especially against flying debris, applies also to explosive blast. Landscaping for mitigation against wildfires improves detection of placed devices. Ventilation system design against airborne biological, chemical, and radiological agents also works for similar hazardous material releases, whether intentional or accidental. Assessing threat, vulnerability, and risk may be complicated when comparing natural against manmade hazards. A natural hazard refers to a natural event such as a flood, wind, or seismic disaster. Historical data have been used by FEMA and other agencies/organizations to economically quantify the risk for natural hazards. Manmade hazards include technological hazards and terrorism and they are distinct from natural hazards primarily in that they originate from human activity. Technological hazards are assumed to be accidental and that their consequences are unintended. There is limited discussion of technological hazards in this document. For manmade hazards, the threat and likelihood of occurrence are less well defined and the associated vulnerabilities have many considerations that impact making good risk management decisions.

ORGANIZATION AND CONTENT OF THE MANUAL

This manual contains many how-to aspects based upon current information contained in FEMA, Department of Commerce, Department of Defense (including Army, Navy, and Air Force), Department of Justice, General Services Administration, Department of Veterans Affairs, Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health, and other publications. It is intended to provide an understanding of the current methodologies for assessing threat/hazard, vulnerability, and risk, and the design considerations needed to improve protection of new and existing buildings and the people occupying them. As needed, this manual should be

supplemented with more extensive technical resources, as well as the use of experts when necessary.

- Chapter 1 presents selected methodologies to integrate threat/hazard, asset value, and vulnerability assessment information. This information becomes the input for determining relative levels of risk. Higher risk hazards require mitigation measures to reduce risk. The chapter also provides an assessment checklist that compiles many best practices (based upon current technologies and scientific research) to consider during the design of a new building or renovation of an existing building. The checklist can also be used to assess the vulnerability of existing buildings within the context of the defined threats.
- Chapter 2 discusses architectural and engineering design considerations (mitigation measures), starting at the perimeter of the property line, and includes the orientation of the building on the site. Therefore, this chapter covers issues outside the building envelope.
- Chapter 3 provides the same considerations for the building – its envelope, systems, and interior layout.
- Chapter 4 provides a discussion of blast theory to understand the dynamics of the blast pressure wave, the response of building components, and a consistent approach to define levels of protection.
- Chapter 5 presents CBR measures that can be taken to mitigate vulnerabilities and reduce associated risks for these terrorist tactics or technological hazards.
- Appendices A, B, and C contain acronyms, general definitions, and CBR definitions, respectively.
- Appendix D describes electronic security systems and design considerations.

- Appendices E and F present a comprehensive bibliography of publications, and the associations and organizations capturing the building security guidance needed by the building sciences community, respectively.

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