Preface

This book is derived from my doctoral research work and is a revised version of my first book, *Risk Assessment for Water Infrastructure Safety and Security* (2011). The topics covered in this book represent advances in research and development over the past several years. The aim of this book is to present material to convey the *essence* of employing the methodology of the "quantitative psychology of intuitive judgments into risk assessment for homeland and critical infrastructure protection and to improve public perception of risk on terrorism" using pipelines, tunnels, underground rapid rail, and transit systems as examples. The emphasis is on applying *quantitative psychology* in risk management in the area of homeland security and defense. However, as it is a *new*, unproven methodology involving human psychology, it has not yet been utilized in these areas.

The book is divided into eight chapters. Chapter 1 presents the significance of risk and acceptability analyses to protect pipelines, tunnels, underground rails, and transit systems against terrorist attacks. The preparedness as well as the preventive and defensive approaches in this book are intended for man-made disasters, because an *act of God* can only be managed and can never be controlled, unlike terrorist acts. The purpose and objectives are discussed in detail to prepare readers for what is to follow in the subsequent chapters.

Chapter 2 deals with material used for fabricating weapons of mass destruction (WMD) and operations for terrorism including a summary of natural disasters. Natural disasters arising from seismic waves and wind loads are already part of considerations in the structural analysis and design of infrastructures. Engineers should also be aware of the engineering designs and planning and construction of critical infrastructure to ward off terrorist attacks (e.g., impact load of improvised explosive devices on structures), which are covered in this chapter. They should also employ protective and defensive measures to mitigate terrorists from causing large-scale destruction.

Chapter 3 outlines the background and system operations of pipelines, tunnels, underground rails, and transit systems as well as other superspeed futuristic trains (e.g., magnetic levitation, Swissmetro, CargoCap, and tubular rail). It discusses hazards in the event of an explosion as well as the formation and flight of missiles,

dispersion of toxic substances, and dangerous debris released due to demolition of infrastructures. Clandestine tunnels used in times of war, including secret manpower mobilization for WMD production and transshipment and illegal tunnels on borders, are also described in this chapter.

Chapter 4 discusses the risk and vulnerability assessment tools and methodologies used by experts and governmental agencies. It also elaborates on the historical development of cumulative prospect theory.

Chapter 5 deals with the probabilistic risk estimation process, event tree analysis, and fault tree analysis. Terrorism activity scenario developments are illustrated from causative event to prescribing consequence value using examples related to pipelines, tunnels, underground rail and transit systems, clandestine tunnels, and transshipment of WMD materials.

Chapters 6 and 7 form the crux of the book. These chapters describe the meaning and significance of risk acceptability analysis based on quantitative psychology of intuitive predictions for homeland and critical infrastructure protection. It has a vital role to compare alternative solutions and operations or used for policy formulation or to select special features of technologies that are mission critical for the safety and security of assets. Chapter 7 integrates risk assessment methodology with intelligence analysis and military intuitive judgment and provides illustrative examples and graphical presentations of different scenarios. It also introduces the role that the military plays to support civilians in the event of terrorist strikes, including regulations that mandate their missions and limitations.

Chapter 8 reviews preparedness and preventive measures and describes *the need for defensive systems* that can discriminate and terminate terrorists before they can sabotage infrastructures. Technologies and operations to detect illegal tunnels, land mines, and improvised explosive devices currently available and being developed are presented in this chapter. The use of *Mother Nature to support warfare* is briefly discussed in the last part of the chapter.

This work is the culmination of tireless effort and perseverance. I share my thoughts, experiences, and ideas and contribute to improving the safety and security of the homeland. I am honored that Mark Listewnik, senior editor at Taylor & Francis Group, my work organization, and all the people who inspired me have given me a chance to make this a reality.