Preface

Today, billions of dollars are being spent annually world wide to develop, manufacture, and operate transportation systems such trains, ships, aircraft, and motor vehicles. During their day-to-day use, thousands of lives are lost due to various types of accidents each year. For example, there were around 1 million traffic deaths and about 40 million traffic injuries worldwide and by 2020, the World Health Organization projects that deaths from accidents will rise to about 2.3 million world wide.

As per some studies, around 70 to 90 percent of transportation crashes are, directly or indirectly, the result of human error. For example, according to a National Aeronautics and Space Administration (NASA) study over 70 percent of airline accidents involved some degree of human error.

Although, the history of the human reliability field may be traced back to the late 1950s, the beginning of the serious thinking on human reliability or error in transportation systems goes back only to the period around the late 1980s. Since the 1980s, over 200 journal and conference proceedings articles on human reliability and error in transportation systems have appeared. However, to the best of the author's knowledge, there is no book on the subject available in the published literature. As the increasing attention is being paid to human error or reliability in transportation systems, the need for a book covering the basics and essentials of general human reliability, errors, factors; and the comprehensive and latest information on human reliability and error in transportation systems, is considered absolutely necessary.

Currently, such information is either available in specialized articles or books, but not in a single volume. This causes a great deal of difficulty to information seekers, because they have to consult many different and diverse sources. This book is an attempt to meet this vital need. The material covered is treated in such a manner that the reader needs no previous knowledge to understand it. The sources of most of the material presented are given in the reference section at the end of each chapter. They will be useful to a reader, if he/she desires to delve deeper into a specific area.

At appropriate places, the book contains examples along with their solutions and at the end of each chapter there are numerous problems to test reader comprehension. This will allow the volume to be used as a text. An extensive list of references on human reliability and error in transportation systems is provided at the end of the book, to give readers a view of the intensity of developments in the area.

The book is composed of 11 chapters. Chapter 1 presents an introductory discussion on human reliability and error in transportation systems, human error in transportation systems-related facts and figures, important human reliability and error terms and definitions, sources for obtaining useful information on human reliability and error in transportation systems, and the scope of the book. Chapter 2 is devoted to mathematical concepts considered useful to perform analysis of human reliability and error in transportation systems and it covers topics such as Boolean algebra laws, probability properties and distributions, and useful mathematical definitions.

Chapter 3 presents introductory human factors including human factors objectives, general human behaviours, human and machine characteristics, human factors data collection sources, and useful human factors guidelines for system design. Basic human reliability and error concepts are covered in Chapter 4. It presents topics such as occupational stressors, human error occurrence reasons and classifications, human performance reliability function, and human reliability and error analysis methods.

Chapter 5 presents a total of nine methods extracted from published literature, considered useful to perform human reliability and error analysis in transportation systems. These methods include fault tree analysis (FTA), the throughput ratio method, technics of operation review (TOR), failure modes and effect analysis (FMEA), Pareto analysis, and the Markov method.

Chapters 6 and 7 are devoted to human error in railways and shipping, respectively. Some of the topics covered in Chapter 6 are railway personnel error prone tasks, important error contributing factors in railways, human error analysis methods, and a useful checklist of statements for reducing the occurrence of human error in railways. Chapter 7 includes topics such as shipping human error related facts, figures, and examples, human factors issues facing the marine industry, risk analysis methods for application in marine systems, fault tree analysis of oil tanker groundings, and reducing the manning impact on shipping system reliability.

Chapter 8 presents various important aspects of human error in road transportation systems. Some of the specific topics covered are operational influences on commercial driver performance, types of driver errors, common driver errors, methods for performing human error analysis in road transportation systems, and bus accidents and driver error in developing countries. Chapter 9 presents various important aspects of human error in aviation including topics such as organizational factors in commercial aviation accidents, factors contributing to flight crew decision errors, types of pilot-controller communication errors, methods for performing human error analysis in aviation, and accident prevention strategies.

Chapters 10 and 11 are devoted to human error in aircraft maintenance and mathematical models for predicting human reliability and error in transportation

systems, respectively. Some of the topics covered in Chapter 10 are reasons for the occurrence of human error in maintenance, major categories of human error in aircraft maintenance and inspection tasks, common error in aircraft maintenance, methods for performing human error analysis in aircraft maintenance, and useful guidelines to reduce human error in aircraft maintenance. Chapter 11 includes topics such as models for predicting human performance reliability and correctability probability in transportation systems, models for predicting human performance reliability subject to critical and non critical human errors and fluctuating environment in transportation systems, and models for performing human error analysis in transportation systems.

This book will be useful to many individuals including system engineers, design engineers, human factors engineers, transportation engineers, transportation administrators and managers, psychology and safety professionals, reliability and other engineers-at-large, researchers and instructors involved with transportation systems, and graduate students in transportation engineering, human factors engineering, and psychology.

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