



RAMPART™: Risk Assessment Method - Property Analysis and Ranking Tool

Background

RAMPART™ technology is incorporated into a risk-based decision support tool for real property that requires no risk analysis expertise on the part of the user. Risk analysts often use computer software as a tool in determining the risk of future events. Typically such software requires substantial expertise from the analyst, for example, in scenario development, data quality assessment, determination of boundary conditions, and interpretation of results. In many cases the analyst must develop or at least design appropriate software. The U.S. General Services Administration (GSA) has recently decided to expand the use of risk-based software in property analysis; however, most GSA users of the software would not be risk analysts.

RAMPART™ software consists of a user interface to elicit information about the building, an expert system that embodies GSA corporate knowledge, as well as Sandia National Laboratories expert knowledge about risk analysis, and a database that contains both data entered by the user during an analysis session and a much larger data set on natural hazards and crime. The results of each analysis are presented graphically on screen and in a written report.

Introduction

GSA buildings house more than one million federal employees in more than 280 million square feet of federally owned and leased properties. In recent years, increasing public and federal concern has focused on the security of federal buildings and the personal safety of the occupants. Past approaches to security and safety have relied primarily on standard real estate and architectural practice—buy, lease, or design and build structures that meet the Uniform Building Codes and the ordinary definition of a “safe” work place. Some risks to occupants are not addressed by this traditional approach, however. Several recent events—Hurricane Andrew in Florida, the Oklahoma City and World Trade Center bombings, and the Northridge earthquake—illustrate that the financial and personal risk associated with unanticipated events can be enormous. For this reason, the GSA is now interested in the development of screening tools to support risk-based property-management decisions; however, few well-developed methods, let alone software, are available for the analysis of risks to buildings. Furthermore, most GSA users of the software would not be risk analysts, but rather property managers, architect-engineers, and security personnel. The RAMPART™ software is a screening-level tool for risk analysis of federal buildings that can support GSA decision making about property management.

Methods

The development of risk software for use by GSA property managers who are not familiar with formal methods of risk analysis entails a number of separate problems: 1) developing methods for the analysis of overall risk to GSA



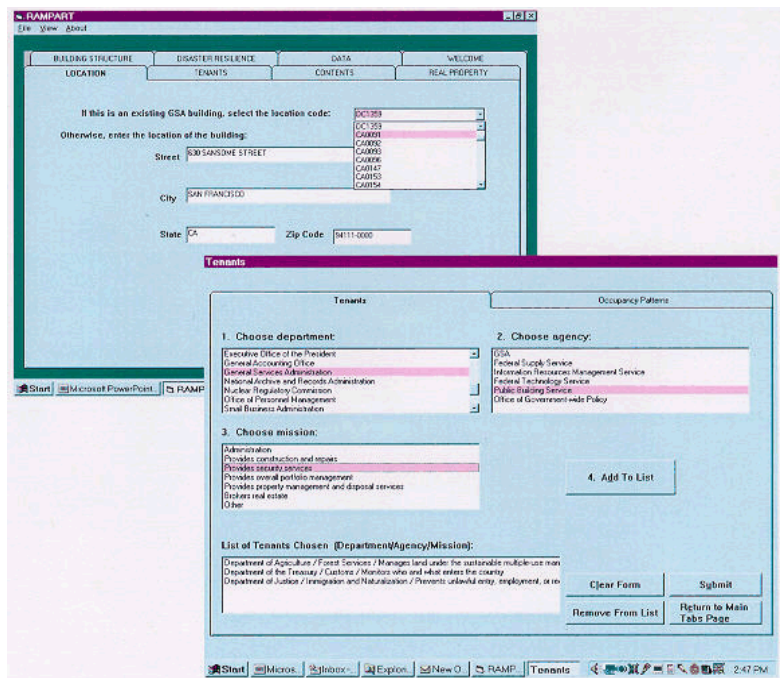
buildings; 2) eliciting GSA corporate knowledge about contributors to risk; 3) embodying the methods and knowledge in a suite of equations that can be implemented as a computer code; and 4) creating a computer application that allows the property manager to generate the same result as a risk analyst. The resulting software must provide results that closely mimic those that would be obtained if the property manager and the risk analyst were able to perform the analysis together.

Five qualitative levels of risk were selected to represent the results of the analysis: very high, high, medium, low, and negligible. The probabilities associated with the qualitative risk levels vary by consequence. For example, loss of continuity of government is considered a high risk at a probability of 10^{-6} , while loss of easily replaced contents is considered a high risk only at a probability of 10^{-1} . A color-coded bar chart shows the risk for the 31 consequences analyzed for each hazard. The label on each bar gives the consequence, the length of the bar is proportional to the probability, and the color of the bar tells the level of risk. This graphical presentation allows the GSA user to see and distinguish at a glance both the infrequent high risks and the frequent low risks that the building presents. The GSA property manager can use the results of the screening-level risk analysis both to determine where more detailed analysis is appropriate and to inform property-management decisions directly.

The RAMPART™ design team worked with the GSA to determine a consensus lists of consequences and hazards of concern to the GSA, ranked in order of importance. The consequences of greatest concern to the GSA are loss of life, injury, loss of mission capability, loss of property, loss of contents, and loss of use of property. The natural hazards of greatest concern are hurricane, tornado, earthquake, winter storm, and flood. Crimes of greatest concern are murder, rape, robbery, assault, burglary, larceny, motor vehicle theft, and arson. The RAMPART™ design team first developed a set of general “risk rules” for each of the five natural hazards and crime. Each general rule attempts to include all factors that influence the probability that the hazard will bring about any of the consequences of concern at any level of severity. The general rule is modified to produce a specific rule for each consequence of concern.

**Software Development:
Design with the User in Mind**

Release Version 1.0 of the RAMPART™ is a stand-alone Visual Basic application for Windows NT 4.0. Several principles guided the development of the user interface. Foremost, the interface does not request any information from the user that a GSA property manager cannot reasonably be expected to have access to. For example, the user is not asked in any way to evaluate risk or to provide data on the probability of natural hazards in the area. Second, to prevent errors, all information elicited from the user is entered via point-and-click buttons, drop-down lists, dialogue boxes, and so on (except the address when an analysis is performed for a new build-



Example of the RAMPART Database

ing). Finally, the user interface has been designed to elicit only those data that will be used in a particular analysis, and to elicit each datum only once, no matter how many times it is used.

The RAMPART™ software draws on existing GSA databases to the extent possible. For example, selecting a GSA building number automatically populates the address of the building, and if the building is listed in GSA's database of historically important buildings, the Building Preservation Plan database, the appropriate questions are answered on the Real Property screen.

Contact

Regina Hunter
International Environmental Analysis Department
P.O. Box 5800, MS 0716
Albuquerque, NM 87185-0716
Phone: (505) 844-5837
Fax: (505) 844-1480
Email: rlhunte@sandia.gov