TY - JOUR

TI - Development and case study of a risk assessment model CUrisk for building fires

AU - George H

DO -

PY - 2006

AB - A fire risk computer model CUrisk is being developed at Carleton University to evaluate fire safety designs for four-story, timber-frame commercial buildings. The model consists of the system model and a number of subsidiary submodels. The system model implements the risk analysis framework and controls data flow of the submodels; it is also responsible for calculating the life hazard of each scenario. Other submodels include Fire Growth and Smoke Movement, Boundary Failure and Fire Spread, Occupant Response and Evacuation, and Building Cost and Economic Loss. Using the outputs of the submodels, the system model calculates three decision-making parameters:the Expected Risk to Life, the Expected Risk of Injury, and the Fire Cost Expectation. These parameters are based on possible fire scenarios and their associated probabilities. This paper provides a brief description of CUrisk, and presents the results of a multi-scenario risk analysis for a four story commercial building.

JA - Fire Science and Technology

L2 - https://www.semanticscholar.org/paper/2a8ea85df52034725f2ffc80e17f47a032132b79

U2 - 2384198121

ER -

TY - JOUR

TI - AAMKS—Integrated cloud-based application for probabilistic fire risk assessment

AU - Adam Krasuski

AU - Adam Krasuski

AU - Adam Krasuski

AU - Simo Hostikka

DO - 10.1002/fam.2861

PY - 2020

AB - Available models of fire risk assessment can still hardly be used for practical engineering problems. They are mostly loosely integrated, complex, computationally demanding applications, and require additional pre‐ or post‐hand‐calculations. However, the latest achievements in computer science enable establishing an easy‐to‐use web‐application with access to enormous computing power in a cloud requiring minimal management effort. In this article, we present a new tool for probabilistic fire risk assessment called Aamks. Our goal is to build an easy‐to‐use, science‐based, practical engineering tool to support building design in day‐to‐day work. To meet the overall goal, we aim at working out an integrated, web‐based application with computational efficiency and scalability allowed by cloud computing. Aamks performs a stochastic analysis of life safety in building fires using deterministic models for fire and evacuation and stochastic sampling of the uncertain input parameters.

JA - Fire and Materials

L2 - https://doi.org/10.1002/fam.2861

U2 - 3036663577

ER -

TY - JOUR

TI - A-Evac: the evacuation simulator for stochastic environment

AU - Adam Krasuski

AU - Karol Kreński

DO - 10.1007/s10694-019-00827-7

PY - 2017

AB - We introduce an open-source software Aamks for fire risk assessment. This article focuses on a component of Aamks - an evacuation simulator named a-evac. A-evac models evacuation of humans in the fire environment produced by CFAST fire simulator. In the article we discuss the probabilistic evacuation approach, automatic planning of exit routes, the interactions amongst the moving evacuees and the impact of smoke on the humans. The results consist of risk values based on FED, F-N curves and evacuation animations.

JA - arXiv: Multiagent Systems

L2 - https://doi.org/10.1007/s10694-019-00827-7

U2 - 2770783377

ER -

TY - JOUR

TI - Aamks: the platform for assessing fire safety of humans in buildings

AU - Karol Kre´nski

AU - Mateusz Fliszkiewicz

AU - M. Fliszkiewicz

DO - 10.1051/matecconf/201824700001

PY - 2018

AB - We introduce an open-source software for fire risk assessment named Aamks. We provide a brief overview of the following aspects of the platform: the motivation for creating Aamks, the architecture of the platform, the user interface, the intended workflow for conducting fire safety analyses, the probabilistic approach to fire risk assessment, the geometry processing, the reasoning from the topology of the building (i.e. automatic planning of exit routes), the interactions amongst the moving evacuees, the impact of smoke on humans and finally the results and the visualization.

JA -

L2 - https://doi.org/10.1051/matecconf/201824700001

U2 - 2905042888

ER -

TY - JOUR

TI - Development of a Fire Risk Assessment Software as an Evaluation Tool and as a Teaching Tool

AU - Dusan Gavanski

AU - Matija Sokola

DO - 10.28945/1452

PY - 2011

AB - Fire and explosion hazards, with consequences to lives and property, are present in various technological processes. A number of methods for qualifying and/or quantifying the fire risk have been developed. This paper presents bespoke software developed for fire risk assessment for buildings in which people work. The software serves two aims - an electronic notepad/calculator/ reminder for fire assessment experts and a teaching tool for students on fire safety and occupational health and safety study programmes.

JA -

L2 - https://doi.org/10.28945/1452

U2 - 2189360026

ER -

TY - JOUR

TI - Presentation of a software method for use of Risk assessment in Building Fire Safety Measure Optimization

AU - Mohsen Mahdinia

AU - Rasoul Yarahmadi

AU - M J Jafari

AU - Mohammad Jafari

AU - Alireza Koohpaei

DO -

PY - 2012

AB - Abstract Background and aim: The property loss and physical injuries due to fire events in buildings demonstrate the necessity of implementation of efficient and performance based fire safety measures. Effective and high efficiency protection is possible when design and selection of protection measures are based on risk assessment. This study aims at presenting a software method to make possible selection and design of building fire safety measures based upon quantitative risk assessment and building characteristics. Methods: based on “Fire Risk Assessment Method for Engineer (FRAME)” a program in MATLB software was written. The first section of this program, according to the FRAME method and based on the specification of a building, calculates the potential risk and acceptable risk level. In the second section, according to potential risk, acceptable risk level and the fire risk level that user want, program calculate concession of protective factor for that building. Results: The prepared software make it possible to assign the fire safety measure based on quantitative risk level and all building specifications. All calculations were performed with 0.001 of precision and the accuracy of this software was assessed with handmade calculations. During the use of the software if an error occurs in calculations, it can be distinguished in the output. Conclusion: Application of quantitative risk assessment is a suitable tool for increasing of efficiency in designing and execution of fire protection measure in building. With using this software the selected fire safety measure would be more efficient and suitable since the selection of fire safety measures performed on risk assessment and particular specification of a building. Moreover fire risk in the building can be managed easily and carefully.

JA - Iran Occupational Health

L2 - https://www.semanticscholar.org/paper/297d01aae36b1a6ce10e5bc48eb8dc873e0347ba

U2 - 2346694248

ER -

TY - JOUR

TI - Fire risk assessment in buildings using fire protection software

AU - Dušan G. Gavanski

AU - Azra Korjenic

AU - Verica Milanko

DO - 10.1504/ijram.2013.054375

PY - 2013

AB - In this investigation, we developed a methodology for inclusion of fire protection and used a methodological approach for fire risk assessment. Present practice of fire risk assessment and prevention measures in the Republic of Serbia is not systematic. To develop a methodological approach of fire risk assessment, a modified matrix for fire risk factors was set up that combines the implementation of modified Delphi and checklist methods into a risk matrix based on the Allgemeine Unfall Versicherungs Anstalt and Berufs Genossenschaften methods. An efficient and rapid fire risk assessment was enabled by the application of our fire protection project solution software of SAFOFP. The results of the investigation were validated by the concrete timber warehouse case study. This fire risk assessment method is applicable to other branches of industry as well as other places aside from Republic of Serbia where the study was conducted.

JA - International Journal of Risk Assessment and Management

L2 - https://doi.org/10.1504/ijram.2013.054375

U2 - 2004324224

ER -

TY - JOUR

TI - Library Fire Risk Assessment Model based on AHP

AU - Jiang Cha

DO -

PY - 2013

AB - Library has many characteristics, such as large fire load, high density of population. In case of fire accident,it will cause great casualties, imponderable economic losses and political impact. It is of great significance to reduce the risk of fire. Building fire risk evaluation is the base of building fire risk management. Carrying out building fire risk evaluation can effectively prevent or control the building fire accident. This paper analyzed fire risk assessment principles, and then introduced the Yaahp software based on the AHP(Analytic Hierarchy Process). On account of above contents, this paper assessed some university library, and put forward measures to reduce the fire risk assessment. The method is instructive and meaningful to engineering practice.

JA - China Public Security

L2 - https://www.semanticscholar.org/paper/e3f61276b5f0ac62d0bc2110be4ada3eb522d0ca

U2 - 2384967639

ER -

TY - JOUR

TI - FLAME: A Parametric Fire Risk Assessment Method Supporting Performance Based Approaches

AU - Enrico Danzi

AU - Luca Fiorentini

AU - Luca Marmo

DO - 10.1007/s10694-020-01014-9

PY - 2020

AB - A fire risk assessment has always been a challenging task. Performance-based approaches to fire engineering have shown that risk-based decisions and fire scenarios are fundamental elements that must be considered in fire safety strategies. A correct assessment of the fire risk allows all the involved stakeholders to identify a specific strategy from among a variety of possibilities. A risk assessment is the best tool to identify comparable fire protection strategies and to measure the reduction in fire risk that can be obtained with each specific prevention and protection measure, i.e., by means of different fire safety strategies. The present paper illustrates a method that takes into account several well-known methods, even some that were developed as far back as in the early seventies. The method is named “FLAME” (Fire Risk Assessment Method for Enterprises). FLAME considers fundamental fire safety aspects instead of making use of sophisticated and time-consuming methods like CFD. FLAME uses the “Fire Safety Concept Tree”, which is explained in detail in the NFPA 550 Standard, as a reference scheme. The method allows the risk to the occupants to be evaluated separately from the risk to the building. Over the years, we have tested the method considering different kinds of buildings and occupancies. We here report the results of an application of the FLAME method to hospitals and health-care facilities. Overall, about 300 compartments (overall size of about 60,000 m2) were analysed, including two hospitals of about 200,000 m2 each. The results of the risk estimation with the FLAME code have been found to be coherent with Italian fire code prescriptions. About 44% of the compartments were defined as being at a Medium risk and 39% as being at a high risk (according to the Italian Fire Code). More than 60% of the hospital compartments were defined as being at a High risk. A good agreement was obtained between the RSET results with those of the method proposed in FLAME when using the current performance-based regulation criteria. The RSET estimation in FLAME considers the occupants’ behaviour and the actual characteristics of the occupants in clinics or hospitals, who often have difficulties due to reduced mobility or an incapacity to understand emergency instructions.

JA - Fire Technology

L2 - https://doi.org/10.1007/s10694-020-01014-9

U2 - 3044226828

ER -

TY - JOUR

TI - Risk Assessment Method Combining Independent Protection Layers (IPL) of Layer of Protection Analysis (LOPA) and RISKCURVES Software: Case Study of Hydrogen Refueling Stations in Urban Areas

AU - Byoungjik Park

AU - Yangkyun Kim

AU - Kwanwoo Lee

AU - Shinwon Paik

AU - Chankyu Kang

AU - Chankyu Kang

AU - Chankyu Kang

DO - 10.3390/en14134043

PY - 2021

AB - The commercialization of eco-friendly hydrogen vehicles has elicited attempts to expand hydrogen refueling stations in urban areas; however, safety measures to reduce the risk of jet fires have not been established. The RISKCURVES software was used to evaluate the individual and societal risks of hydrogen refueling stations in urban areas, and the F–N (Frequency–Number of fatalities) curve was used to compare whether the safety measures satisfied international standards. From the results of the analysis, it was found that there is a risk of explosion in the expansion of hydrogen refueling stations in urban areas, and safety measures should be considered. To lower the risk of hydrogen refueling stations, this study applied the passive and active independent protection layers (IPLs) of LOPA (Layer of Protection Analysis) and confirmed that these measures significantly reduced societal risk as well as individual risk and met international standards. In particular, such measures could effectively reduce the impact of jet fire in dispensers and tube trailers that had a high risk. Measures employing both IPL types were efficient in meeting international standard criteria; however, passive IPLs were found to have a greater risk reduction effect than active IPLs. The combination of RISKCURVES and LOPA is an appropriate risk assessment method that can reduce work time and mitigate risks through protective measures compared to existing risk assessment methods. This method can be applied to risk assessment and risk mitigation not only for hydrogen facilities, but also for hazardous materials with high fire or explosion risk.

JA - Energies

L2 - https://doi.org/10.3390/en14134043

U2 - 3182112822

ER -

TY - JOUR

TI - Simulation models for fire risk assessment

AU - W.G.B. Phillips

DO - 10.1016/0379-7112(94)90023-x

PY - 1994

AB - Fire safety engineering cannot develop into a mature discipline like civil and electrical engineering until practical tools for the comparison and measurement of fire risk are widely accepted. The Fire Research Station is developing a fire risk assessment methodology (CRISP) based on simulation models and Monte Carlo methods. Designers will be able to use there tools to meet quantified criteria of safety and cost.

JA - Fire Safety Journal

L2 - https://doi.org/10.1016/0379-7112(94)90023-x

U2 - 1978561385

ER -

TY - JOUR

TI - Risk assessment of a timber frame building by using CRISP simulation

AU - Jouni Björkman

AU - Jouni Björkman

AU - Jouni Björkman

AU - Esko Mikkola

DO - 10.1002/fam.770

PY - 2001

AB - The fire risk assessment model CRISP2 was applied to a 4-storey apartment building. The case building was an actual 4-storey timber-framed building. Partly predetermined design alternatives were used in sequential simulations. CRISP2 cannot take into account the frame-material of the building in a satisfactory way, because the wall thickness, structural fire resistance or lining materials in the fire room cannot be modelled. It was found that adding smoke alarms almost halved the risk level. The risk levels 1-2 x 10(-5) obtained are not far from comparable levels of fire death statistics from Finland, the United Kingdom, Sweden and Norway.

JA - Fire and Materials

L2 - https://doi.org/10.1002/fam.770

U2 - 2012113937

ER -

TY - JOUR

TI - An Object-oriented Simulation (crisp 11) For Fire Risk Assessment

AU - Jeremy Fraser-Mitchell

DO - 10.3801/iafss.fss.4-793

PY - 1994

AB -

JA - Fire Safety Science

L2 - https://doi.org/10.3801/iafss.fss.4-793

U2 - 2051175353

ER -

TY - JOUR

TI - Modern sensitivity analysis of the CESARE-Risk computer fire model

AU - Abraham M. Hasofer

DO - 10.1016/j.firesaf.2008.07.007

PY - 2009

AB - Abstract This paper introduces two new modern methods of global sensitivity analysis for computer models: Fourier Amplitude and Sobol, as well as a modern factor screening method: the Morris method. The methods are applied to the sensitivity analysis of the apartment fire module of the CESARE-Risk building fire computer model with eight input factors and door and window open. Two output variables are considered: the maximum temperature reached and the time of onset of untenable conditions. Response surfaces previously derived for the model [Jianguo Qu, Response surface modelling of Monte Carlo fire data, Ph.D. Thesis, Victoria University, Melbourne, Australia, 2003, http://eprints.vu.edu.au/archive/00000260/01/Qu,\_Jianguo.pdf] are used to speed up the computations. For the maximum temperature all three methods agree that the most sensitive factors are the window height and width factors, followed by the fuel area factor. The largest interaction was between the length of room and the fuel area factor. For the time of untenable conditions the Fourier Amplitude and Sobol methods agreed that one factor, the flame spread rate, had overwhelming significance. The only significant Sobol interaction was between the width of room and the flame spread rate.

JA - Fire Safety Journal

L2 - https://doi.org/10.1016/j.firesaf.2008.07.007

U2 - 2013006953

ER -

TY - JOUR

TI - Cesare-risk: An Aid For Performance-based Fire Design-some Preliminary Results

AU - V.R. Beck

AU - L. Zhao

DO - 10.3801/iafss.fss.6-159

PY - 2000

AB - A risk assessment model termed CESARE-RISK is being developed. The model can be used to quantify the performance of a building fire safety design system in terms of two parameters; namely a risk to life safety parameter and an economic parameter. Accordingly, it is possible to identify alternative cost-effective fire safety system design solutions. Preliminary results have been obtained for a three-storey apartment building. The results were compared with fire statistics. I was found that in comparative terms, the model predictions agree well with statistical data, whereas in absolute terms the predicted results are higher.

JA - Fire Safety Science

L2 - https://doi.org/10.3801/iafss.fss.6-159

U2 - 2042726447

ER -

TY - JOUR

TI - Expert System for Building Fire Safety Analysis and Risk Assessment

AU - Piotr Tofiło

AU - Piotr Tofiło

AU - Piotr Tofiło

AU - Marek Konecki

AU - Marek Konecki

AU - Jerzy Gałaj

AU - Waldemar Jaskółowski

AU - N. Tuśnio

AU - Marcin Cisek

DO - 10.1016/j.proeng.2013.04.146

PY - 2013

AB - Abstract The paper contains a description of an expert system for risk assessment and fire risk analysis in buildings, which is currently being developed in SGSP. The creation of such a system is dictated by the needs of the communities of fire protection designers, specialists and verification bodies for a clear and easily accessible tool that will be further developed as needed in order to support and improve the national design and construction process for fire safety engineering. The system offers the following parametric modules: the geometry of the building, the fire size, convection column, smoke generation, detection, ventilation, evacuation, intervention, construction, criteria for sensitivity and risk.

JA - Procedia Engineering

L2 - https://doi.org/10.1016/j.proeng.2013.04.146

U2 - 2024535899

ER -

TY - JOUR

TI - IMPROVING THE QUALITY OF FIRE RISK ASSESSMENT BY USING EVACUATION SIMULATION SOFTWARE

AU - Srđan Popov

AU - Mirjana Laban

AU - Suzana Vukoslavčević

AU - Slobodan M. Šupić

AU - Slobodan Šupić

AU - Sanja Milanko

DO - 10.14311/asfe.2015.074

PY - 2016

AB - The time required for evacuation of all persons who could be present in the building during a fire event depends on a number of factors, some of which are very difficult to predict. In order to achieve more realistic evaluation of the evacuation process, engineers are increasingly turning towards evacuation computer models. These evacuation models could help reduce the consequences related to a wide range of adverse events, such as fires, by indicating critical points on the evacuation paths. At the same time, simulation tools can be used for exploring how certain changes within the real system could affect the efficiency of evacuation and fire safety of the building even before they are implemented. The computer model for the Amphitheatres in FTS in Novi Sad has been created using simulation software – Pathfinder, based on SRPS TP 21. This paper presents contribution of evacuation software models to the quality of fire safety assessment.

JA - Applications of Structural Fire Engineering

L2 - https://doi.org/10.14311/asfe.2015.074

U2 - 2315100085

ER -

TY - JOUR

TI - Influence of architectural and planning solutions on fire risk in public buildings

AU - Alizhan Kazkeyev

AU - Auyezova Ulpan

DO - 10.54355/tbus/1.3.2021.0005

PY - 2021

AB - This article is devoted to the study of the influence of architectural and planning solutions on fire risk in public buildings. The calculation and assessment of fire risk was carried out on the example of one floor of a conditional office building with a free layout, where the tenant himself can change it at will. The input data for the calculation were two different layouts of the same floor, while the total square footage remained unchanged. As a calculation tool used the software package FireCat, which includes the programs Pyrosim, Pathfinder and FireRisk. The calculation took into account parameters such as the degree of fire resistance of the building, the number of rooms, the width and direction of door opening, the number of people on one floor of the building, including various mobility groups. Simulation modeling allowed to compare architectural and planning solutions for the same building and choose the best layout in terms of individual fire risk.

JA - Technobius

L2 - https://doi.org/10.54355/tbus/1.3.2021.0005

U2 - 3207747790

ER -

TY - JOUR

TI - FIERAsystem: A Fire Risk Assessment Tool to Evaluate Fire Safety in Industrial Buildings and Large Spaces

AU - N. Benichou

AU - A Kashef

AU - Irene M. A. Reid

AU - George V. Hadjisophocleous

AU - David A. Torvi

AU - Gaetan Morinville

DO - 10.1177/1042391505049437

PY - 2005

AB - FIERAsystem is a computer model for evaluating fire protection systems in industrial buildings. The model has been developed as a tool to assist fire protection engineers, building officials, fire service personnel and researchers in performing fire safety engineering calculations, and can be used to conduct hazard and risk analyses, as well as to evaluate whether a selected design satisfies established fire safety objectives. While the model is primarily designed for use in warehouses and aircraft hangars, it can be modified for application to other industrial buildings. This paper describes the framework for FIERAsystem, along with its capabilities and flexibility. Individual models used to perform calculations are discussed, particularly those that calculate fire development and life hazard. A hazard analysis of an aircraft hangar is then described in detail, as an example of the types of calculations this model can perform. Methods used by the model to conduct risk assessments are also briefly described.

JA - Journal of Fire Protection Engineering

L2 - https://doi.org/10.1177/1042391505049437

U2 - 2109496816

ER -

TY - JOUR

TI - On the assessment of robustness

AU - Jack W. Baker

AU - Matthias Schubert

AU - Michael Havbro Faber

DO - 10.1016/j.strusafe.2006.11.004

PY - 2008

AB - A framework for assessing robustness is proposed, taking basis in decision analysis theory. Robustness is assessed by computing both direct risk, which is associated with the direct consequences of potential damages to the system, and indirect risk, which corresponds to the increased risk of a damaged system. Indirect risk can be interpreted as risk from consequences disproportionate to the cause of the damage, and so the robustness of a system is indicated by the contribution of these indirect risks to total risk. A framework is presented for measuring robustness in this way, and implications for system modelling and acceptable levels of robustness are discussed. Numerical studies of idealized structural systems are performed using this framework, to demonstrate the use of the proposed robustness index and provide insight into system properties affecting robustness. Considered exposures include the design live load and an extraordinary exposure representing a fire or explosion that causes the loss of one or more system components. The results indicate that properties affecting system reliability, such as number of components or the stochastic properties of the load, also affect robustness. Perhaps more interestingly, it is seen that properties such as failure consequences and time to repair a damaged system also affect this measure of robustness. The assessment framework is applied here to study damage tolerance, but the procedure can be applied as well to other aspects of robustness such as tolerance to human error in design or construction.

JA - Structural Safety

L2 - https://doi.org/10.1016/j.strusafe.2006.11.004

U2 - 2000766394

ER -

TY - JOUR

TI - A preliminary investigation to develop a semi-probabilistic model of informal settlement fire spread using B-RISK

AU - Antonio Cicione

AU - Colleen Wade

AU - Michael Spearpoint

AU - Lesley Gibson

AU - Richard Walls

AU - David Rush

DO - 10.1016/j.firesaf.2020.103115

PY - 2020

AB - Abstract In South Africa alone, there are more than 5000 informal settlement fires a year, where a single incident can leave up to 10000 people homeless. The government and local authorities of countries with informal settlements, that extend over large areas, have no tools to simulate fires to identify high risk areas, or to quantify the magnitude of an incident to which they may need to respond. It is with this backdrop that the paper seeks to develop a semi-probabilistic method to determine fire spread rates in informal settlements. Data from a full-scale fire experiment is used to validate the fire spread rates predicted by B-RISK from which a simplified semi-probabilistic analysis method is developed that can estimate fire spread rates in informal settlements. B-RISK simulations are then compared to an actual informal settlement fire incident to assess its predictive capabilities. The paper also discusses how the effect of wind has been included and what additional features could be incorporated to obtain more realistic informal settlement fire spread predictions. This work provides the first step in a complex problem where it is difficult to accurately define input parameters.

JA - Fire Safety Journal

L2 - https://doi.org/10.1016/j.firesaf.2020.103115

U2 - 3027941301

ER -

TY - JOUR

TI - Developing Probabilistic Design Fires for Performance-based Fire Safety Engineering☆

AU - Greg Baker

AU - Colleen Wade

AU - Michael Spearpoint

AU - Charley Fleischmann

DO - 10.1016/j.proeng.2013.08.109

PY - 2013

AB - Abstract Research is ongoing in New Zealand to develop a new risk-informed fire safety design tool called B-RISK that is a combination of deterministic and probabilistic calculation functionality. The purpose of the tool is so that users can examine the risk and uncertainty that is part of modeling building fires in a rational and systematic fashion. A specific module in B-RISK that generates design fire inputs for iterative B-RISK simulations is described in the paper, and statistical distributions for the fire growth rate and peak heat release rate are developed for a residential-scale building occupancy. The use of this statistical data within B-RISK is also demonstrated and comparisons drawn with new building code compliance provisions that have recently come into effect in New Zealand. © 2013 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of the Asia-Oceania Association for Fire Science and Technology.

JA - Procedia Engineering

L2 - https://doi.org/10.1016/j.proeng.2013.08.109

U2 - 2025612378

ER -

TY - JOUR

TI - Predicting Spill Plumes with the Fire Risk Zone Model B-RISK

AU - Roger Harrison

AU - Colleen Wade

AU - Michael Spearpoint

DO - 10.1007/s10694-013-0364-3

PY - 2014

AB - Recent experimental research on spill plume entrainment has developed a range of empirically-based formulae for smoke management design. These formulae form the spill plume entrainment model in B-RISK, a new fire risk zone model. This article describes the performance of B-RISK in predicting spill plume entrainment. Selected experimental data from the series of reduced-scale experiments used to form the new design formulae have been used for model validation, along with other full-scale experimental data from ‘hot smoke tests’ conducted to assess the performance of installed smoke management systems. B-RISK provides predictions of the plume clear-layer height that generally agree with experimental results within the range of experimental error. This gives confidence in its use to predict spill plume entrainment for smoke management design purposes.

JA - Fire Technology

L2 - https://doi.org/10.1007/s10694-013-0364-3

U2 - 1985092794

ER -

TY - JOUR

TI - Fire Safety System Effectiveness for a Risk-Informed Design Tool

AU - Kevin Frank

DO -

PY - 2013

AB -

JA -

L2 - https://www.semanticscholar.org/paper/2f722f1c12fcca18212deaee6d5c51205d0ffdb5

U2 - 76612384

ER -

TY - JOUR

TI - FiRECAM: An Equivalency and Performance-Compliance Tool for Cost-Effective Fire Safety Design

AU - N. Bénichou

AU - D. Yung

DO -

PY - 2001

AB - Many countries in the world, including Canada, are moving towards the more flexible performance-based building regulations and away from the present restrictive prescription-based regulations. Performance-based regulations allow the designers and building officials the freedom to come up with innovative designs that will provide a level of safety that satisfies the objectives established by the regulations. Such innovative designs often lead to lower fire protection costs. The implementation of performance-based building regulations can be facilitated by the development of engineering tools that can help assess the overall fire safety performance of a building. This paper presents a fire risk assessment model, FiRECAM, which can be used as an equivalency and a performance-compliance design tool for cost-effective fire safety. The paper also describes a case study using this tool as well as the evaluation and deployment plans for the tool. INTRODUCTION SUPPORT TO PERFORMANCE-BASED CODES To support the introduction of performance-based codes, many research organizations around the world are developing computer models that can help designers predict how fire and smoke develop in a compartment and spread to other compartments in a building [1]. These models include both field and zone models. The field models divide a compartment into many cells and compute, using computational fluid dynamics (CFD), the thermal and flow conditions in each cell. These models provide detailed information in a compartment but are computationally intensive and require a lot of computer time even with the fastest computers. An example of the field models is the JASMINE model that was developed by the Fire Research Station in the U.K. [2]. Different from the field models, the zone models divide a fire compartment into a number of characteristic zones, such as the upper hot layer, the lower cold layer, the fire plume and the compartment boundary. The conditions in each zone are modelled separately and then linked together through fluid dynamics and heat transfer equations. This approach simplifies the intensity of computation and allows previously developed models, such as plume models or ceiling jet models, to be applied. A notable model of this type is the CFAST model that was developed by the National Institute of Standards and Technology (NIST) in the U.S. [3]. Other more comprehensive models that predict not only the fire and smoke spread in a building, but also the expected risk to life of the occupants, are also being developed. These risk assessment models combine the interaction of fire growth, smoke spread, occupant response and evacuation, and fire department response to assess the expected risk to life of the occupants. Three such models that are being developed are the CESARE-RISK [4] that is being developed at the Victoria University of Technology in Australia and FiRECAM [5] and FIERAsystem [6] at the National Research Council of Canada (NRC). In this paper, the computer fire risk-cost assessment model, FiRECAM, which is being developed at NRC, is briefly described. Then, as an example, FiRECAM is used to show how the fire safety performance of various design options of an 8-storey Canadian provincial court building can be assessed. The architectural layout of the building and the characteristics of the occupants are described. The results of the assessment of the safety levels, provided to the occupants by the various fire safety design options, are then shown and discussed. Finally, the evaluation and deployment plans of FiRECAM are presented to show how this tool can be evaluated and used by the fire community. NRCs RISK ASSESSMENT MODEL FIRECAM One of the areas in which the Fire Risk Management Program of NRC is heavily involved in is the development of computer fire models that can be used to evaluate the fire protection systems in buildings. This section describes the fire risk assessment model, FiRECAM, a computer model, which can be used in the design of office and apartment buildings. Description of FiRECAM To provide a tool that can assess the overall fire safety performance of a building, NRC is developing a computer fire risk-cost assessment model called FiRECAM (Fire Risk Evaluation and Cost Assessment Model). A flowchart of FiRECAM is shown in Figure 1. The model can assess both the expected risks to life of the occupants in a building, as well as the expected costs of fire protection and fire losses in the building. The separation of life risks and protection costs in FiRECAM avoids the difficulty of assigning a monetary value to human life and allows the comparison of risks and costs, separately. The expected risks to life (ERL) value can be used for performance compliance (performance-based codes) or code equivalency consideration (prescriptive-based codes), whereas the expected costs of fire value can be used for cost-effectiveness considerations. Therefore, the model can be used to identify cost-effective fire safety designs that provide a level of safety that is required by the code (performance-based code), or alternative designs that provide a level of safety that is equivalent to that of a codecompliant design (prescription-based code). The model is being developed in partnership with the Public Works and Government Services Canada (PWGSC) and the Department of National Defence Canada (DND). Economic Legend Models Run Once at Beginning Models Run for each Scenario Data Flow Direction Design Fire Building Evaluation Fire Department Response Fire Growth Fire Department Action/Effectiveness Boundary Failure

JA -

L2 - https://www.semanticscholar.org/paper/e061e8c0992e064f188b975df97d09995211faab

U2 - 119928851

ER -

TY - JOUR

TI - A DESCRIPTION OF THE PROBABILISTIC AND DETERMINISTIC MODELLING USED IN FIRECAM

AU - D. Yung

AU - G. Proulx

DO -

PY - 1999

AB - To support the introduction of performance-based building regulations in Canada in the year 2003, the National Research Council of Canada (NRC) is developing a computer fire risk-cost assessment model that can be used to assess both the expected risk to life to the occupants and the expected costs of fire protection and fire losses in a building. The computer model that is being developed at NRC is called FiRECAM (Fire Risk Evaluation and Cost Assessment Model). This paper gives a brief description of the probabilistic and deterministic modelling concepts that are used in FiRECAM. In addition, the paper shows the results of its recent application to a six-storey Canadian federal government office building where the existing fire protection systems were being re-evaluated to see how they could be upgraded in a cost-effective manner to meet the current building code requirements.

JA -

L2 - https://www.semanticscholar.org/paper/1e9102feb559c9de0c73be854aa04b9cc92b5b50

U2 - 130861190

ER -

TY - JOUR

TI - Developing the Structure of a Fire Risk Index Method for Timber-frame Multistorey Apartment Buildings.

AU - Daniel Larsson

DO -

PY - 2000

AB - The Fire Risk Index Method is a tool for assessing fire safety in multi-storey apartment buildings. This report contains a description of how Version 1.2 of the Fire Risk Index Method was developed. The terminology frequently used in the development process of the method is also explained. The use of the Fire Risk Index Method is described and illustrated by an example. The method is applied to an existing timber-frame building and the results are compared to a corresponding concrete building. Other existing risk assessment methods are briefly described and evaluated in the report.

JA -

L2 - https://www.semanticscholar.org/paper/edcf0f937e810eb4f8c9aa9d361885a45fd54956

U2 - 2119730638

ER -

TY - JOUR

TI - Using a Delphi Panel for Developing a Fire Risk Index Method for Multistorey Apartment Buildings

AU - Björn Karlsson

AU - Daniel Larsson

DO -

PY - 2000

AB - This report contains a description of how Version 1.2 of the Risk Index method for assessing fire safety in multi-storey apartment buildings was developed. It specifically addresses how a Delphi panel of experts was used to help develop and fine-tune the index method. The report contains all communications to and from the Delphi panel and describes how answers were interpreted and how the current version of the method was gradually arrived at. Acknowledgements: The work reported here was mainly financed by Nordic Wood, NUTEK and SBUF and co-ordinated by Tratek. © Copyright: Brandteknik, Lunds tekniska hogskola, Lunds universitet, Lund 2000. Department of Fire Safety Engineering Lund University P.O. Box 118 SE-221 00 Lund Sweden brand@brand.lth.se http://www.brand.lth.se/english Telephone: +46 46 222 73 60 Brandteknik Lunds tekniska hogskola Lunds universitet Box 118 221 00 Lund brand@brand.lth.se http://www.brand.lth.se Telefon: 046 222 73 60 ii Table of

JA -

L2 - https://www.semanticscholar.org/paper/dbc0c36f578369469f67d7bbb5ae142c14ce3990

U2 - 785463183

ER -

TY - JOUR

TI - Evaluation of a Fire Risk Index Method for Multistorey Apartment Buildings

AU - Hans Hultquist

AU - Björn Karlsson

DO -

PY - 2000

AB - A need for methods to assess fire risks in timber frame buildings lead to the development of FRIMMAB, a Fire Risk Index Method for Multi-storey Apartment Buildings. The main objective of this report is to evaluate this method against a different risk analysis method, in this case a standard QRA

(quantitative risk analysis) based on an event tree. Four different multi-storey apartment buildings in the Nordic countries were analysed in this study. The QRA resulted in a certain ranking of the four buildings with respect to fire risk. The Fire Risk Index Method was then used to analyse the same buildings. Three slightly different approaches were used to arrive at a fire risk index for each building. The Index Method results gave exactly the same ranking as the quantitative risk analysis for all three approaches. The conclusion of the analysis is therefore that FRIM-MAB seems to work reasonably well for multi-storey apartment buildings, but further studies are recommended to confirm this.

JA -

L2 - https://www.semanticscholar.org/paper/6264422fb998bdc103f57ce08ae1861cb79a4342

U2 - 1547048205

ER -

TY - JOUR

TI - Risk Index Method—A Tool for Building Fire Safety Assessments

AU - Dorota Brzezińska

AU - Paul Bryant

DO - 10.3390/app11083566

PY - 2021

AB - The use of fire safety engineering and performance-based techniques continues to grow in prominence as building design becomes more ambitious, increasing complexity. National fire safety enforcement agencies are tasked with evaluating and approving the resulting fire strategies, which have similarly continued to become more advanced and specialist. To assist with the evaluation of fire strategies, this paper introduces a methodology dedicated to sustainable building fire safety level simulations. The methodology derives from ideas originally introduced in British Standard Specification PAS 911 in 2007 and combines a visual representation of fire strategies with a semi-quantitative approach to allow for their evaluation. The concept can be applied to a range of industrial fire safety assessments and can be modified for specific needs relative to different industries.

JA - Applied Sciences

L2 - https://doi.org/10.3390/app11083566

U2 - 3155406473

ER -

TY - JOUR

TI - Risk Index Method–A Tool for Sustainable, Holistic Building Fire Strategies

AU - Dorota Brzezińska

AU - Paul Bryant

DO - 10.3390/su12114469

PY - 2020

AB - Modern fire safety engineering seeks to ensure buildings are safe from fire by applying optimum levels of fire safety and protection resources without the need to overprotect. Similarly, the principles of sustainability aim to ensure resources are suitably applied to meet social, economic, and environmental objectives. However, there is a mismatch between the actual application of fire safety and the sustainability objectives for buildings, typically caused by the highly prescriptive historical approaches still largely adopted and legislated for in many countries. One solution that is increasingly adopted is the more flexible, “performance-based” fire engineering approach that bases fire safety and protection provisions on the development of key performance objectives, some of which could be influenced by sustainability engineering propositions for buildings, but very often this does not appear to be enough. The proposed new concept prompts separate assessment and scoring of the eight most important fire safety factors, allowing for calculation of the fire strategy risk index (FSRI). By comparing the FSRI of the actual submitted strategy against the baseline strategy, enforcement agencies or other interested stakeholders will have a methodology to determine optimal fire safety solutions for buildings.

JA - Sustainability

L2 - https://doi.org/10.3390/su12114469

U2 - 3028866475

ER -

TY - JOUR

TI - Integration of fire safety and building design

AU - Haejun Park

AU - Brian J. Meacham

AU - Nicholas A. Dembsey

AU - Mark Goulthorpe

DO - 10.1080/09613218.2014.913452

PY - 2014

AB - A new framework is presented to facilitate better incorporation of building fire safety performance options into the building design process. Based on the building design process and key design decisions undertaken at each phase, a knowledge set is developed to aid building designers to understand better the effects of design decisions on building fire performance. This also minimizes potential competing objectives in later design phases by sharing necessary concerns in advance. Drawing on the knowledge set, a conceptual building fire safety evaluation tool illustrates how primary building designers and fire safety engineers can quantitatively assess fire safety performance for different solutions. It is shown how building fire safety performance attributes can be arranged by building design phase, how various scenarios can be explored, and how appropriately balanced building design and fire safety design solutions can be identified at different phases of the building design process.

JA - Building Research and Information

L2 - https://doi.org/10.1080/09613218.2014.913452

U2 - 2052349208

ER -

TY - JOUR

TI - Risk-based process plant design considering inherent safety

AU - Samith Rathnayaka

AU - Faisal Khan

AU - Paul Amyotte

DO - 10.1016/j.ssci.2014.06.004

PY - 2014

AB - An inherently safer approach is becoming a key parameter of process and plant design. However, a lack of established guidelines and methods hinders most industries from utilizing inherent safety concepts to a full extent. This paper presents a risk-based design decision-making tool considering inherent safety. The tool is called the Risk-based Inherent Safety Index (RISI). The proposed indexing approach is an extension of the Integrated Inherent Safety Index (I2SI) earlier developed by Khan and Amyotte (2004, 2005). The RISI incorporates both consequence and probability of accident occurrence reduction through application of inherently safer design principles throughout the process design life cycle. Unlike other available dimensionless index-based matrices, risk components of the proposed indexing approach are expressed in terms of SI units. The RISI is applicable at different stages of the process design life cycle. Analytical and subjective equations assess the damage potential of major process accidents: fire, explosion and toxic release. The explosion accident scenario is studied separately in terms of vapor/gas explosion and dust explosion. The decision-making potential based on the quantitative results of the methodology is demonstrated by evaluating alternatives for biodiesel production.

JA - Safety Science

L2 - https://doi.org/10.1016/j.ssci.2014.06.004

U2 - 1982491806

ER -

TY - JOUR

TI - Risk of human fatality in building fires: A decision tool using Bayesian networks

AU - Daniela Hanea

AU - Ben Ale

DO - 10.1016/j.firesaf.2009.01.006

PY - 2009

AB - Abstract The Netherlands is the most densely populated country of the European Union, which makes space very expensive. This leads to increasing complexity of the cities’ layout and other public spaces, together with a large number of people involved. Authorities would like to know whether new and innovative building designs ensure an appropriate level of safety of people in case of fire, before the accident happens, and to be prepared for the so-called “low probability–high consequences” accidents. Therefore, they need a tool to help them estimate the extent of a fire in a building, given any combination of possible conditions and any unexpected course of events during an emergency. This paper discusses the possibility of using Bayesian belief nets for this task. Using this approach, the people in charge can take decisions at different stages of the design process of a building regarding the location, the structure, the loading of the building, the types of fire protection systems inside the building, as well as the characteristics of the fire brigade that fights the possible fire. In the current study, usefulness of the approach is investigated using a small example. This will show the feasibility of the approach for the Netherlands situation and give authorities involved confidence that building a large comprehensive model would fulfil their needs for a support tool in the planning process. The effort to gather real data therefore was restricted as demonstration of fitness for purpose was the primary objective.

JA - Fire Safety Journal

L2 - https://doi.org/10.1016/j.firesaf.2009.01.006

U2 - 1972872845

ER -

TY - JOUR

TI - Development and Application of the Fire Brigade Intervention Model

AU - Roger Marchant

AU - Nabeel Kurban

AU - Stephen Wise

DO - 10.1023/a:1012491720486

PY - 2001

AB - A performance based building code [1] was introduced in Australia in 1996. In order that fire brigades could ensure that their functional role was maintained in the building code, a method of quantifying fire brigade roles was required. In response to this issue, the Australasian Fire Authorities Council (AFAC) formed a Performance Based Fire Engineering Committee. This committee developed a model that determines the time taken by a fire brigade to undertake its activities at a fire scene.

JA - Fire Technology

L2 - https://doi.org/10.1023/a:1012491720486

U2 - 1820239231

ER -

TY - JOUR

TI - Assessing and mitigating vulnerability and fire risk in historic centres: A cost-benefit analysis

AU - Julio Tozo Neto

AU - Tiago Miguel Ferreira

DO - 10.1016/j.culher.2020.04.003

PY - 2020

AB - Abstract Assessing and mitigating fire risk and vulnerability is of paramount importance, especially in historical centres, where the characteristics of the buildings and these areas themselves significantly contribute to the ignition and propagation of fire. Federal regulations require buildings to follow guidelines aimed at reducing fire risk, which may require undesirable changes to the architectural and historical characteristics of old constructions. In order to solve this conflict, some methodologies explicitly designed for the assessment of fire risk in ancient buildings, namely the ARICA and the FRI method, have been developed in recent years. A study recently conducted at the Historic Centre of Guimaraes, in Portugal, in which the condition of 269 buildings was assessed, revealed that a high percentage of these buildings present a moderate to high fire risk. Based on this previous study, the present work discusses the improvement in the fire safety of the Historic Centre of Guimaraes through the application of a series of risk mitigation strategies, which are analyzed resorting to a GIS tool. Analysis revealed that the application such intervention strategies, with an average cost of 28.48 euros per square metre, led to a reduction of the number of buildings considered to be of moderate to high fire risk from 67% to 1%, and to an increase of the percentage of buildings complying with regulations from 6% to 58%.

JA - Journal of Cultural Heritage

L2 - https://doi.org/10.1016/j.culher.2020.04.003

U2 - 3034526883

ER -

TY - JOUR

TI - An Integrated Method for Fire Risk Assessment in Residential Buildings

AU - Hongfu Mi

AU - Yaling Liu

AU - Wenhe Wang

AU - Guoqing Xiao

DO - 10.1155/2020/9392467

PY - 2020

AB - Building fires are characterized by high uncertainty, so their fire risk assessment is a very challenging task. Many indexes and parameters related to building fires are ambiguous and uncertain; as a result, a flexible and robust method is needed to process quantitative or qualitative data and update existing information when new data are available. This paper presents a novel model to deal with the uncertainty of the residential building fire risk and systematically optimize its performance effectiveness. The model includes fuzzy theory, evidence reasoning theory, and expected utility methods. Fuzzy analysis hierarchy process is applied to analyze the residential building fire risk index system and determine the weights of the risk indexes, while the evidence reasoning operator is used to synthesize them. Three buildings were selected as a case study to illustrate the proposed fire risk model. The results show that the fire risk level of three buildings corresponds to “moderate” or below which is consistent with the previous study. These results also truly reflect the actual situation of fire safety in these residential buildings. The application of this model provides a powerful mathematical framework for cooperative modeling of the fire risk assessment system and allows data to be analyzed step by step in a systematic manner. It is expected that the proposed model could provide managers and researchers with flexible and transparent tools to effectively reduce the fire risk in the system.

JA - Mathematical Problems in Engineering

L2 - https://doi.org/10.1155/2020/9392467

U2 - 3080583429

ER -

TY - JOUR

TI - Fire risk assessment for building operation and maintenance based on BIM technology

AU - Luqi Wang

AU - Wenxian Li

AU - Weimin Feng

AU - Ruiyin Yang

DO - 10.1016/j.buildenv.2021.108188

PY - 2021

AB - Abstract Building fires are the most common types of fires, and most fires occur during the operation and maintenance periods of buildings. A majority of the risk factors causing fire are inextricably linked to human life, which can only be controlled but not eliminated. Fire risk assessment is necessary to control fire risk and improve the preventive ability. The assessment method established in this study can scientifically calculate the fire risk value by quantifying the fire risk index of buildings. Combined with BIM technology, this method can quickly and reliably assess the fire risk of the target building model and realise the organic unity of science, effectiveness and economy. Based on the fire risk analysis method for engineering (FRAME), we propose an assessment index system for buildings in the operation and maintenance periods in terms of the potential risk level, acceptable risk level and protection level. In addition, a risk value calculation model for the operation and maintenance periods is established, and the risk value assessment standard is set to improve the firefighting ability of buildings. Furthermore, the assessment indexes are incorporated into the family attributes in Revit software to realise the information interaction between the assessment system and the model. The results show that BIM technology can be applied effectively to fire safety, to ensure that the fire risk prevention and control ability of the target has a more intuitive scientific basis. It also provides a direction and ideas for the development and application of BIM technology.

JA - Building and Environment

L2 - https://doi.org/10.1016/j.buildenv.2021.108188

U2 - 3186050591

ER -

TY - JOUR

TI - Risk assessment based on maximum allowable damage

AU - Cadena Gomez

AU - Jaime Eduardo

DO - 10.14264/37e6595

PY - 2021

AB - Demonstrating the adequate fire safety performance of a building design is a requisite part of the approvals process in the construction industry. Risk assessments provide a powerful tool to quantify fire risk, which is often used as a proxy for fire safety performance. However, the nature of the risk assessment process means that it may also open the door for unacceptable losses to be present in the form of latent risks. This research analyses this problem and puts forward key elements needed for better fire risk assessments and an inherently safer built environment.In a performance based environment, fire safety engineering can take advantage of frameworks and methodologies to explicitly demonstrate performance through qualitative or quantitative risk assessments. The latter are preferred as they evoke a sense of objectivity and scientific rigor and due to their extensive use in high-risk settings, e.g. chemical and nuclear safety. Quantitative risk assessments can be deterministic or probabilistic. The former focuses on specific consequences, while the latter quantifies the likelihood of a range of undesired consequences.Probabilistic risk quantification can result in significant consequences appearing to be acceptable conditional on the fact that their likelihood is low enough. However, three problems arise from this: i) public responses to fires which results in large loss of life completely invalidate the premise of acceptable risk based on negligible likelihood; ii) the subjective basis and lack of structured approaches to identify scenarios that can actually challenge the performance; and iii) the reliance of probabilistic risk assessments on scarce statistical data is a topic of great concern in other fields, with some practitioners suggesting that they be reserved for specialized applications. As probabilistic risk assessments are often promoted as the default choice for demonstrating fire safety performance, the danger of providing a false sense of safety is significant. This concern has motivated this research, which has the overarching objective of proposing an alternative methodology for fire risk assessment that promotes an inherently safer built environment.This research is divided in two parts. The first part details the limitations associated to risk assessments, to probabilistic risk assessments and to the existing guidance for fire risk assessments. These limitations include data availability, the subjective basis for scenario identification and an unknown degree of trustworthiness of the results. The second part proposes a consequence-driven fire risk assessment methodology, applies it to three distinct case studies and evaluates both its advantages and limitations.The proposed methodology focuses on the potential range of fire consequences. The upper end of this consequences range should be below a stakeholder-predefined maximum allowable damage for the performance to be adequate. This concept is the basis of the methodology, correspondingly named Maximum Allowable Damage (MAD). The consequence range is estimated for a ‘bare-bones’ design, which excludes those active safety measures that cannot be ensured to work over the life of a building (e.g. sprinklers). This estimation allows identifying possible modifications to its constitutive elements as to achieve adequate performance. This approach is aligned with the inherently safer design philosophy which designs out hazards and introduces safety measures only on an as needed basis.MAD uses a high-level representation to describe how the fire damage materializes, i.e. damage model. This representation provides an initial bounding of the scenarios. The variables, their values, and underlying assumptions within the damage model are logged, allowing to judge their trustworthiness. Trustworthiness in MAD is a function of the strength of knowledge and output sensitivity of each variable and assumption. To characterize the upper end of the damage potential, a deductive reasoning approach is implemented, where the central question is which conditions are necessary (and plausible) to exceed the maximum allowable damage. Hence, scenarios are iterated and both the damage model and the information registry are updated as needed.MAD allowed obtaining insight on the fire safety performance of three distinct case studies. This insight was formulated as actionable recommendations that enabled an adequate performance. The trustworthiness of each assessment was a key component in achieving and defining these recommendations. Both the damage model and the information registry serve as supports for the trustworthiness of the assessment and as a basis for third party reviews and future reassessments. As observed in all case studies, the acceptance criteria largely defines the degree of conservatism required in the assessment, addressing one of the main criticisms to consequence-driven analyses.While MAD does not produce a metric to be used as a universal yardstick for fire risk, it is a means to trustworthy insight into fire risk. This insight can be used to ensure that a building is inherently safe before other methods are applied to optimize the fire safety design.

JA -

L2 - https://doi.org/10.14264/37e6595

U2 - 3190537528

ER -

TY - JOUR

TI - Generic Risk Assessment for Fire Safety: Performance Evaluation and Optimisation of Design Provisions: Performance Evaluation and Optimisation of Design Provisions

AU - Gianluca De Sanctis

DO - 10.3929/ethz-a-010562998

PY - 2015

AB - Decisions concerning investments into fire safety should not only focus on the reduction of the consequences, but also on the costs of fire safety measures. Accordingly, a balanced ratio between costs and consequences should be aspired, not only at object but also at societal level. The latter concerns especially regulatory agencies, which set fire safety provisions for society, and influence building construction practice. Such optimal fire safety solutions may be considered as outcome of a rational decision-problem. The goal of this thesis is to demonstrate the benefits of generic fire risk assessment as a practical tool to face decision-problems and to provide the basis to improve fire safety provisions for society. This applies for prescriptive as well as for performance-based fire safety code provisions. The performance of such safety provisions is evaluated under realistic conditions by a probabilistic approach, in order to consider the inherent randomness of fire events and the incomplete knowledge on the system. Probabilistic models are derived for basic variables that are used to represent realistic fire conditions, e.g. describing either the fire exposure, the interaction of fire safety measures with the fire, or the model uncertainties. A generic risk model can be used to evaluate the consequences at object level and aggregate them over the building portfolio, in order to estimate the expected consequences at societal level. Assessing the risk at portfolio level allows, on one hand, to validate and to calibrate the model to observed consequences, which are usually collected at portfolio level as well. On the other hand, the risk reduction of fire safety measures can be evaluated and provide the basis for rational decision-making. Different strategies for decision-making can be followed and are discussed within the application of the framework for generic risk assessment. One strategy, followed mainly by fire authorities, is to demand the same level of safety of alternative fire safety solutions as standard fire safety solutions, which is not explicitly defined. A reliability-based approach is used to evaluate the level of safety of current prescriptive and performance-based design provisions for steel structures under realistic fire conditions. The level of safety between different design approaches can be compared and the equivalence of a sprinkler concept to a standard structural design concept can be demonstrated. The LQI (Life Quality Index) acceptance criterion is used as another decision strategy and is a risk-based efficiency criterion to derive the optimal allocation of societal resources for life safety. The criterion is applied to optimise the minimal required door width for retail buildings as part of the means of egress. The risk is assessed by probabilistic engineering models that represent the fire as well as the evacuation situation. Monetary optimisation of decision alternatives can be performed if the acceptability regarding life safety – as evaluated by the LQI acceptance criterion – is fulfilled. A generic risk model is developed based on an engineering-driven approach to model the financial consequences of a fire in single family houses. The model is calibrated at portfolio level to data, in order to reduce the bias associated with the engineering models. The generic risk model is used to judge the cost efficiency of home smoke alarms for single family houses.

JA -

L2 - https://doi.org/10.3929/ethz-a-010562998

U2 - 2602387387

ER -

TY - JOUR

TI - A Performance-based Approach For Fire Safety Engineering: A Comprehensive Engineering Risk Analysis Methodology, A Computer Model And A Case Study

AU - M. Mathews

AU - D. Karydas

AU - M. Delichatsios

AU - Delichatsios

DO - 10.3801/iafss.fss.5-595

PY - 1997

AB - This paper presents a systematic approach for fire safety engineering, utilizing risk analysis principles. The described methodology is the foundation for a computer program developed for the performance-based fire risk assessment of buildings and the evaluation of alternative safety systems that may maintain the risk of building occupants and equipment, in respect to fire hazards, at tolerable levels. The computer program evaluates fire risk of a specified facility by automatically (1) generating an event tree and enumerating all credible accident scenarios that may follow a range of initiating events, (2) assessing of resulting consequences and associated impact, and (3) calculating the corresponding lkelihood of occurrence of each accident scenario. This methodology and the corresponding computer program comprise modeled physical phenomena and stochastic characteristics associated with each elemental event of a scenario. A case study is presented wherein various strategies of risk reduction are compared by implementation of this technique and by deployment of the developed computer tool.

JA - Fire Safety Science

L2 - https://doi.org/10.3801/iafss.fss.5-595

U2 - 1964733652

ER -

TY - JOUR

TI - Research on fire risk assessment of high-rise buildings based on fuzzy mathematics and set-value statistics theory

AU - Jun Ma

AU - Jia Wang

AU - Xiao-Ping Zhou

AU - Ya-Yun Wei

DO -

PY - 2018

AB - Once a high-rise building fire will cause serious casualties and huge loss of property, meanwhile, it will also have bad social impact. In order to avoid or reduce the occurrence of fire, effective prevention and control of high-rise building fire has become an important subject. Building fire risk assessment is the basis of building fire risk management, fire risk assessment of buildings can effectively prevent the occurrence of fire accidents and control the loss of the accident. Based on the study of the role and relationship of all factors in building fire safety, this paper establishes an index system for fire risk assessment of high-rise buildings , which can be evaluated from five aspects, it includes the active fireproofing ability of building, passive fireproofing ability of building, fire fighting and rescue ability, evacuation capability and fire management level. Considering the relationship between the measured value and the evaluation index range from the point of view of system security, the corresponding weight system is determined. Considering that the fire risk assessment of high-rise buildings is characterized by many evaluation parameters, fuzzy evaluation conclusions and complicated evaluation process, in this paper, based on the traditional fuzzy evaluation model, the set value statistics method is introduced in the fuzzy mathematics, and the corresponding evaluation interval is redefined. it adopts the Linear interpolation method to show the evaluation results which is expressed in membership degree in quantitative form, and a new linear weighted average fuzzy comprehensive evaluation model is established. The evaluation results of the new model are more objective, clear and universal.

JA -

L2 - https://www.semanticscholar.org/paper/80f0c7374eb091b812176321a2a706492748ce12

U2 - 2802072996

ER -

TY - JOUR

TI - Fire risk assessment for typical buildings and software development

AU - Chen Juan-jua

DO -

PY - 2015

AB - For the sake of improving the scientificity and practicability of building fire risk assessment,a new risk assessment method combining cluster analysis and AHP was worked out in the building fire risk assessment system. Firstly,5 kinds of fire risk assessment systems for typical buildings were established according to the characteristics of buildings,employing AHP which has the advantages of both semi-quantitative methods and qualitative methods. And questionnaire and cluster analysis were integrated to calculate the weight values of indexes in the assessment system. Through scoring on each index,the fire risk level for a building can be assessed. Then on basis of the above theory,a Building Fire Safety Level Calculator was developed by using of Visual Basic. NET. The fire risk of a mall in Wuhan was assessed by using of the calculator. The result shows that the mall is at a fire safety level of Ⅱ,low fire danger,which conforms with its real fire safety situation.

JA - China Safety Science Journal

L2 - https://www.semanticscholar.org/paper/f9ee97bebe40234b0b8f6dfb8cb6f68858b52211

U2 - 2351872125

ER -

TY - JOUR

TI - A model for quantitative fire risk assessment integrating agent-based model with automatic event tree analysis

AU - Farid Wajdi Akashah

AU - Rachid Ouache

AU - Jianping Zhang

AU - Michael A. Delichatsios

DO - 10.1016/b978-0-12-816514-0.00004-7

PY - 2020

AB - Abstract Fire is one of the catastrophic accidents that affect people, environment, and properties. Therefore, different models are developed under qualitative, semiquantitative, and quantitative approaches for fire risk assessment. Quantitative approach is considered as the best because of its precision. However, uncertainty is still the main challenge to analyze fire accidents effectively. Consequently, this chapter comes out with new methodology to handle uncertainty of fire assessment and generate automatic event tree for quantitative analysis. The developed methodology is based on the following steps: (1) the Consolidated Model of Fire and Smoke Transport (CFAST) as a deterministic model to determine the state of the fire, (2) @RISK as a probabilistic model to predict a possible operational state for each agent using Monte Carlo simulation, and (3) an agent-based model (ABM) to coordinate interactions and determine the risk of all possible scenarios. The results of the developed methodology in this study are more precise and reliable than those of the classical models.

JA -

L2 - https://doi.org/10.1016/b978-0-12-816514-0.00004-7

U2 - 2980307239

ER -

TY - JOUR

TI - Development of index system for inherently safer process design using an integrated approach

AU - Junjie Feng

AU - Bin Zhang

AU - Wei Xu

AU - Bing Sun

AU - Fan Zhang

AU - Fan Zhang

AU - Zhang Fan

AU - Jie Jiang

AU - Jie Jiang

DO - 10.1016/j.cjche.2019.07.012

PY - 2019

AB - Abstract With a growing population, an increasing number of petrochemical facilities are built with larger capacity and more complexity, which pose a great risk to assets, community and environment. The value of inherently safer design is recognized with time by all stakeholders, and an effective tool is needed to evaluate and compare inherent safety of alternative technologies. This study developed a safety index to evaluate existing technologies for their safety levels and guide inherently safer design. The Integrated Risk-based Safety Index (IRSI) was developed based on a comprehensive review of petrochemical processes, incident cases from Sinopec and US Chemical Safety Board, and existing safety index systems. The IRSI included all major hazards, including fire, explosion, toxic release, dust explosion, physical explosion, and runaway. Also, the integrated life cycle approach considered chemical hazards, equipment failure rates and safety measures in this risk-based index. Advanced modeling techniques, PHAST simulation and Neural Network, were used in the development of three novel sub-indices in the projects, fire, explosion and toxic release. The index system could be easily incorporated into a user friendly tool for the ease of application. A case study of hydrogen dioxide was conducted using the IRSI, which showed its capability for evaluating the safety level of process facilities.

JA - Chinese Journal of Chemical Engineering

L2 - https://doi.org/10.1016/j.cjche.2019.07.012

U2 - 2965428998

ER -

TY - JOUR

TI - Fire risk assessment for large-scale commercial buildings based on structure entropy weight method

AU - Fang Liu

AU - Fang Liu

AU - Shengzhong Zhao

AU - Shengzhong Zhao

AU - Miaocheng Weng

AU - Yongqiang Liu

DO - 10.1016/j.ssci.2016.12.009

PY - 2017

AB - Abstract Based on the fire characteristic and the maintenance of fire equipment in the large-scale commercial buildings, this paper proposed a fire risk assessment system for large-scale commercial buildings. The assessment system focus on evaluating the safety performance of the fire protection system in the buildings. Firstly, the index system of the assessment system was determined by on-site investigation and experts' suggestions. Secondly, the weight of each index was determined by the structure entropy weight method. Thirdly, the score rules were determined according to the regulations from the relevant laws and design codes. Finally, the score and the corresponding fire risk level could be obtained. Moreover, four large-scale commercial buildings in Chongqing, China have been taken as examples to calculate the values of the fire risk level by the proposed assessment system. In addition, the fire safety performance of the four buildings were analyzed.

JA - Safety Science

L2 - https://doi.org/10.1016/j.ssci.2016.12.009

U2 - 2567876258

ER -

TY - JOUR

TI - Fire risk assessment of multi-story buildings based on fragility analysis

AU - Thomas Gernay

AU - Negar Elhami Khorasani

AU - Maria Eugenia Moreyra Garlock

DO -

PY - 2017

AB - Recent efforts aim at assessing the fire performance of structures in a probabilistic framework. But there is still no well-established method to quantify the reliability of entire buildings. Previous works focused on isolated structural members, therefore not allowing for a determination of the global safety level of buildings. Here, a new methodology is developed to quantify the reliability of buildings in fire. The methodology uses Monte Carlo simulations for constructing fragility functions associated with different fire breakout locations in a building, then combines the functions to characterize the overall building conditional probability of failure, and finally incorporates the probabilistic models for intensity measure and fire occurrence likelihood. The methodology is applied to multi-story steel buildings. This work addresses fire reliability at the building scale, and therefore is useful for standardizing safety level as well as for evaluating community resilience.

JA -

L2 - https://www.semanticscholar.org/paper/153c2a130bac78edfb621950f61053cb857a7516

U2 - 2610145072

ER -

TY - JOUR

TI - Societal decision-making for optimal fire safety

AU - Katharina Fischer

AU - Katharina Fischer

DO - 10.3929/ethz-a-010243009

PY - 2014

AB - Fire safety measures save lives and reduce economic losses caused by building fires. However, these benefits come at a cost, because fire safety is not free of charge. An economic optimum is achieved when the total costs of fire and fire safety are minimized. Of course, fire safety decisions cannot be based only on economic reasoning. The safety of building occupants is an important boundary condition for monetary optimization. Societal resources for life saving measures are limited and should be invested where the largest risk reduction can be achieved. Thus, also the definition of acceptance criteria for decisions regarding investments into life safety should be based on efficiency considerations. The focus of this thesis is on the optimization of societal investments for preventive building fire safety. The starting point is the formulation of a general decision problem consisting of two parts: monetary optimization and societal risk acceptance. The optimization may be performed either by a private decision-maker or at societal level. The acceptability of fire safety decisions with respect to life safety, on the other hand, is always evaluated from a societal point of view. Quantitative acceptance criteria can be derived based on the marginal life saving costs principle, which ensures that societal resources are directed to the most efficient risk reduction measures available. Decisions on fire safety measures are generally made by the owner of a building. At societal level, investments into building fire safety are controlled mainly based on codes and regulations. The owner is free to optimize fire safety using his own objective function, provided that he fulfils the minimum requirements defined by the code. Traditionally, fire safety is regulated based on prescriptive rules defining in detail which measures have to be taken to reduce fire risk. In order to increase the flexibility of code-based fire safety design, a number of countries around the world have adopted performance-based codes, which specify the design objectives, but leave the concrete choice of measures to the designers. Unfortunately, the code objectives are rarely formulated in quantitative terms. In this thesis it is shown how quantitative safety goals for code-based design may be derived from a generic risk-informed framework for balancing the costs and benefits of fire safety. Following this approach, both prescriptive and performance-based fire safety codes can be based on the same principles of monetary optimization and acceptable life safety. Fire safety decisions are decisions under uncertainty. Optimizing fire safety thus requires risk assessment for evaluating the effect of safety investments on the expected monetary and human consequences of fire. For a comparison between the uncertain benefits of fire safety measures and their costs, the risk has to be assessed in absolute terms, with as little bias as possible. The present thesis explores the use of statistical data to reduce the modelling bias resulting from assumptions and simplifications used to estimate the risk. A framework for the calibration of engineering fire risk models with data collected by, for instance, fire brigades or insurance companies is developed. The proposed approach allows a combination of engineering knowledge with observations from real fire events, making the best use of both sources of information.

JA -

L2 - https://doi.org/10.3929/ethz-a-010243009

U2 - 1157854087

ER -

TY - JOUR

TI - SCHEMA-SI: A Hybrid fire safety engineering tool-Part I: Tool theoretical basis

AU - A. Muller

AU - F. Demouge

AU - Mejdi Jeguirim

AU - Philippe Fromy

DO - 10.1016/j.firesaf.2012.07.003

PY - 2013

AB - Abstract SCHEMA-SI is an engineering tool able to evaluate the performance of building fire safety system. It uses a dynamic hybrid model, which means that discrete events and continuous phenomenon are interconnected at each instant. The model has been developed as a tool to assist fire protection engineers in performing fire safety engineering calculations. This tool may be also used to conduct risk assessments and to evaluate whether selected design strategies are sufficiently safe in case of fire in a specific building. Part I of this paper describes the basis of the SCHEMA-SI tool. Sub-models used to perform calculations are discussed. Part II of this paper focuses on a real case study.

JA - Fire Safety Journal

L2 - https://doi.org/10.1016/j.firesaf.2012.07.003

U2 - 2001764796

ER -

TY - JOUR

TI - SCHEMA-SI : A HYBRID FIRE SAFETY ENGINEERING TOOL

AU - A. Muller

AU - F. Demouge

AU - Mejdi Jeguirim

DO - 10.1016/j.firesaf.2013.01.022

PY - 2011

AB - SCHEMA-SI is an engineering tool able to evaluate the performance of building fire safety system. It uses a dynamic hybrid model, which means that discrete events and continuous phenomenon are interconnected at each instant. The model has been developed as a tool to assist fire protection engineers in performing fire safety engineering calculations. This tool may be also used to conduct risk assessments and to evaluate whether selected design strategies are sufficiently safe in case of fire in a specific building. This paper describes the basis of the SCHEMA-SI tool. Sub-models used to perform calculations are discussed.

JA -

L2 - https://doi.org/10.1016/j.firesaf.2013.01.022

U2 - 2182237962

ER -

TY - JOUR

TI - Probabilistic Methods to Assess the Fire Risk of an Industrial Building

AU - Ruxandra Dârmon

DO - 10.1016/j.promfg.2020.03.078

PY - 2020

AB - Abstract Fire safety is one of the major issues that affects the whole life cycle of a building from the early design stages until the dismantling. A risk management plan gives a better overview of the whole activity process, revealing the relations between all the factors involved during the building service life. The use of engineering principles in designing the fire safety strategy can improve the design flexibility and it can often reduce the costs related to the fire protection materials and equipment. Due to the complexity of the building system, a probabilistic approach is considered in order to assess the risk and consequences associated with a fire event in an industrial building. The event trees method has been used to assess the frequency of a fire event in an industrial building and the associated consequences. The probability risk assessment criteria are set considering the property protection and business continuity objectives in addition to life safety requirements. The article covers a study case of fire risk assessment regarded as an optimization technique for sustainable manufacturing and a better management of the fire protection systems in the industrial buildings. A probabilistic approach for an engineering problem provides a numerical value of risk, which can also be useful to quantify the probability of unlikely events associated with severe consequences. Moreover, the probabilistic risk analysis provides data for cost-benefit analysis, which is the starting point for any cost optimisation strategy.

JA - Procedia Manufacturing

L2 - https://doi.org/10.1016/j.promfg.2020.03.078

U2 - 3024793439

ER -

TY - JOUR

TI - The development of a full probabilistic risk assessment model for quantifying the life safety risk in buildings in case of fire

AU - Bart Van Weyenberge

DO -

PY - 2019

AB - In het kader van dit onderzoek is een probabilistisch model ontwikkeld dat het brandveiligheidsniveau van een gebouwontwerp kan kwantificeren en dit berekende veiligheidsniveau kan evalueren aan de hand van een vooraf gedefinieerd aanvaardbaar risicocriterium. De ontwikkelde methodiek kan zowel prescriptieve als op prestatie-gebaseerde ontwerpmethoden objectiveren door rekening te houden met de onzekerheid van ontwerpparameters en de betrouwbaarheid van veiligheidssystemen. Het model bestaat uit zowel een deterministisch als een probabilistisch gedeelte. Het deterministische kader is opgebouwd uit verschillende deelmodellen om zowel de verspreiding van brand en rook, als de interactie met evacuerende personen te simuleren. Verschillende deelmodellen zijn ontwikkeld om het effect van geimplementeerde veiligheidsmaatregelen zoals detectie, sprinklers , rook- en warmteafvoersystemen, enz. mee in rekening te brengen. Het probabilistische kader is opgebouwd uit modellering van responsoppervlakken, steekproeftechnieken en ontwerp van grenstoestanden. De methodiek maakt gebruik van deze technieken om de nodige rekenkracht te beperken. Het uiteindelijke resultaat wordt vertaald naar een kans op sterfte, een individueel risico en een groepsrisico. De grote meerwaarde van de ontwikkelde methodiek is dat het mogelijk wordt om verschillende ontwerpmethodieken objectief met elkaar te vergelijken en het positieve effect van verbeterde veiligheidstechnieken en redundantie mee in rekening te brengen in het eindresultaat.

JA -

L2 - https://www.semanticscholar.org/paper/25949135082932307b65f008cb989994f5e4e8aa

U2 - 2988253116

ER -

TY - JOUR

TI - Development of IFC based fire safety assesment tools

AU - Anca Cosmina Taciuc

AU - Jan Karlshøj

AU - Anne Dederichs

DO -

PY - 2016

AB - Due to the impact that the fire safety design has on the building's layout and on other complementary systems, as installations, it is important during the conceptual design stage to evaluate continuously the safety level in the building. In case that the task is carried out too late, additional changes need to be implemented, involving supplementary work and costs with negative impact on the client. The aim of this project is to create a set of automatic compliance checking rules for prescriptive design and to develop a web application tool for performance based design that retrieves data from Building Information Models (BIM) to evacuate the safety level in the building during the conceptual design stage. The findings show that the developed tools can be useful in AEC industry. Integrating BIM from conceptual design stage for analyzing the fire safety level can ensure precision in further design decisions

JA -

L2 - https://www.semanticscholar.org/paper/afbbfb1cd522df5e65e91159db59c53de4b1ab59

U2 - 2592489484

ER -

TY - JOUR

TI - Combining engineering and data-driven approaches: Development of a generic fire risk model facilitating calibration

AU - G. De Sanctis

AU - Katharina Fischer

AU - Jochen Köhler

AU - Michael Havbro Faber

AU - Mario Fontana

DO - 10.1016/j.firesaf.2014.08.017

PY - 2014

AB - Fire risk models support decision making for engineering problems under the consistent consideration of the associated uncertainties. Empirical approaches can be used for cost-benefit studies when enough data about the decision problem are available. But often the empirical approaches are not detailed enough. Engineering risk models, on the other hand, may be detailed but typically involve assumptions that may result in a biased risk assessment and make a cost-benefit study problematic. In two related papers it is shown how engineering and data-driven modeling can be combined by developing a generic risk model that is calibrated to observed fire loss data. Generic risk models assess the risk of buildings based on specific risk indicators and support risk assessment at a portfolio level. After an introduction to the principles of generic risk assessment, the focus of the present paper is on the development of a generic fire risk model for single family houses as an example. The risk model considers the building characteristics of a single family house as well as the uncertainties associated with the fire spread in a building and the intervention of the fire brigade.

JA - Fire Safety Journal

L2 - https://doi.org/10.1016/j.firesaf.2014.08.017

U2 - 1963573252

ER -

TY - JOUR

TI - Architecture design of fire direct property loss evaluation system software of mobile terminals

AU - Zhang Ze-jiang

DO -

PY - 2010

AB - The software architecture design process of a PDA device based on embedded expert system,"fire direct property loss assessment of mobile terminal system" was introduced.The software was based on a public safety industry standard "fire direct property loss of statistical methods" GA185—1998 issued by Ministry of Public Security,which solved software development and preparation issues of PDA devices embedded.It can be used for fire losses calculation and statistics of housing construction,equipment and other property and heritage building,and can generate data files for the statistics and summary in matching "fire direct property loss evaluation PC system".The direct property loss calculation and statistics can be conducted anywhere in the fire scene easily,and to give the fire staff a considerable advantage.

JA - Journal of Safety Science and Technology

L2 - https://www.semanticscholar.org/paper/d963e51a12b45bce612e86f814fb029e82ab93eb

U2 - 2389358512

ER -

TY - JOUR

TI - Fire Code Inspection and Compliance: A Game-Theoretic Model Between Fire Inspection Agencies and Building Owners

AU - Puneet Agarwal

AU - Puneet Agarwal

AU - Kyle Hunt

AU - Shivasubramanian Srinivasan

AU - Jun Zhuang

DO - 10.1287/deca.2020.0410

PY - 2020

AB - Fire-code inspection and compliance are among the highest priorities for fire-inspection agencies to reduce the loss of life and property that can result from fire incidents. Requirements for code ...

JA - Decision Analysis

L2 - https://doi.org/10.1287/deca.2020.0410

U2 - 3026869944

ER -

TY - JOUR

TI - Fire hazard in buildings: review, assessment and strategies for improving fire safety

AU - Venkatesh Kodur

AU - Puneet Kumar

AU - Muhammad Masood Rafi

DO - 10.1108/prr-12-2018-0033

PY - 2019

AB - The current fire protection measures in buildings do not account for all contemporary fire hazard issues, which has made fire safety a growing concern. Therefore, this paper aims to present a critical review of current fire protection measures and their applicability to address current challenges relating to fire hazards in buildings.,To overcome fire hazards in buildings, impact of fire hazards is also reviewed to set the context for fire protection measures. Based on the review, an integrated framework for mitigation of fire hazards is proposed. The proposed framework involves enhancement of fire safety in four key areas: fire protection features in buildings, regulation and enforcement, consumer awareness and technology and resources advancement. Detailed strategies on improving fire safety in buildings in these four key areas are presented, and future research and training needs are identified.,Current fire protection measures lead to an unquantified level of fire safety in buildings, provide minimal strategies to mitigate fire hazard and do not account for contemporary fire hazard issues. Implementing key measures that include reliable fire protection systems, proper regulation and enforcement of building code provisions, enhancement of public awareness and proper use of technology and resources is key to mitigating fire hazard in buildings. Major research and training required to improve fire safety in buildings include developing cost-effective fire suppression systems and rational fire design approaches, characterizing new materials and developing performance-based codes.,The proposed framework encompasses both prevention and management of fire hazard. To demonstrate the applicability of this framework in improving fire safety in buildings, major limitations of current fire protection measures are identified, and detailed strategies are provided to address these limitations using proposed fire safety framework.,Fire represents a severe hazard in both developing and developed countries and poses significant threat to life, structure, property and environment. The proposed framework has social implications as it addresses some of the current challenges relating to fire hazard in buildings and will enhance overall fire safety.,The novelty of proposed framework lies in encompassing both prevention and management of fire hazard. This is unlike current fire safety improvement strategies, which focus only on improving fire protection features in buildings (i.e. managing impact of fire hazard) using performance-based codes. To demonstrate the applicability of this framework in improving fire safety in buildings, major limitations of current fire protection measures are identified and detailed strategies are provided to address these limitations using proposed fire safety framework. Special emphasis is given to cost-effectiveness of proposed strategies, and research and training needs for further enhancing building fire safety are identified.

JA -

L2 - https://doi.org/10.1108/prr-12-2018-0033

U2 - 2975077293

ER -

TY - JOUR

TI - Overcoming risk assessment limitations for potential fires in a multi-occupancy building

AU - Jaime E. Cadena

AU - Juan P. Hidalgo

AU - Cristian Maluk

AU - David Lange

AU - David Lange

AU - David Lange

AU - Jose L. Torero

AU - Andrés F. Osorio

DO - 10.3303/cet1977078

PY - 2019

AB - Decision-making under risk has been a key issue in systems with a potential for major losses such as

chemical process industries (Bhopal - 1984, Toulouse - 2001) or high occupancy buildings (World Trade

Center - 2001, Grenfell Tower - 2017). For the past decades, engineering disciplines have supported risk

management decision-making through the implementation of risk assessments using quantitative approaches.

The popularity of this approach relates to the quantitative definition of risk given by Kaplan in 1981, who

decomposed risk into a set of scenarios, probability of occurrence and consequences. Recently, research on

quantitative risk assessments (QRA) has reported key limitations on identifying the set of scenarios and

estimating their probability of occurrence. These limitations may lead to uncertainties of up to three orders of

magnitude that affect the QRA’s ability of delivering reliable information to stakeholders. This research uses

an alternative definition of risk and applies it to a case study of a multi-occupancy building in the event of a

fire. The proposed approach quantifies the maximum damage potential (MDP) of the system when all the

active safety measures are allowed to fail, even those with low failure frequencies. The system’s MDP is

compared to its maximum allowable damage (MAD), which is previously defined by the stakeholders. This

approach allows defining design modifications and operational rules aiding the development of the building’s

fire safety strategy. Finally, a comparison between the obtained results and a typical QRA is used to comment

on the suitability of the proposed approach when evaluating risk in complex systems.

JA - Chemical engineering transactions

L2 - https://doi.org/10.3303/cet1977078

U2 - 2985221533

ER -

TY - JOUR

TI - A model for estimating property loss risks in building fires

AU - Antti Paajanen

AU - Tuula Hakkarainen

AU - Kati Tillander

DO -

PY - 2015

AB -

JA -

L2 - https://www.semanticscholar.org/paper/690649593eb611ef8d8b499c0104c34368a1df5d

U2 - 2972946536

ER -

TY - JOUR

TI - Lessons Learned in ICFMP Project for Verification and Validation of Computer Models for Nuclear Plant Fire Safety Analysis

AU - Monideep K. Dey

DO -

PY - 2010

AB -

JA - Transactions of the American Nuclear Society

L2 - https://www.semanticscholar.org/paper/11816aae874b5cc94ac19b4c1b631ee6783fe2f1

U2 - 2521867402

ER -

TY - JOUR

TI - A Framework for Risk-Informed Performance-Based Fire Protection Design for the Built Environment

AU - Alexander Alvarez

AU - Alexander Ryan Alvarez

AU - Brian J. Meacham

AU - Nicholas A. Dembsey

AU - J. R. Thomas

DO - 10.1007/s10694-013-0366-1

PY - 2014

AB - Performance-based fire protection design (PBFPD) approaches have now been in use for more than 20 years. One might be tempted to conclude that the current ‘state of the art’ is working well. However, application of PBFPD remains limited, several shortcomings exist, and an increasing number of countries are moving toward ‘prescribed performance’ to address the gaps. There are many factors contributing to these problems with PBFPD. Research has been carried out in two principal problem areas: the relationship between occupants and fire safety measures in the context of holistic building performance expectations during everyday use of the building, and also the lack of specifics within current PBFPD approaches. To address these concerns, a new framework for risk-informed PBFPD has been developed, centered on the study of systems formed by specific building types and their associated occupants. This framework replaces generic guidance with a more in-depth and targeted “building-occupant” system approach. This article focuses on how a successful implementation of the new risk-informed PBFPD approach will require acceptance of the need for a paradigm shift from one in which fire is the center of the problem to one in which building performance metrics are evaluated in case of fire events. This article also details the different steps of the new PBFPD process and how this process differs from the current ones, notably in separating technical steps from political steps related to decision making and policy. Finally, this article presents how the new approach is practically applied to a project, focusing on a proof of concept of the new PBFPD process.

JA - Fire Technology

L2 - https://doi.org/10.1007/s10694-013-0366-1

U2 - 2130142500

ER -

TY - JOUR

TI - The Economic Decision Guide Software (EDGeS) Tool: User Guidance

AU - Jennifer F. Helgeson

AU - Jennifer Helgeson

AU - Shannon A. Grubb

AU - David H. Webb

DO - 10.6028/nist.sp.1214

PY - 2017

AB - ........................................................................................................................................ iii Acknowledgements ....................................................................................................................... v List of Figures ................................................................................................................................ x List of Tables ............................................................................................................................... xii List of Acronyms ......................................................................................................................... xv

JA -

L2 - https://doi.org/10.6028/nist.sp.1214

U2 - 2770222594

ER -

TY - JOUR

TI - Economic Decision Guide Software (EDGe$) Online Tutorial: University Pandemic Planning Analysis Use Case

AU - Jennifer F. Helgeson

AU - Jennifer Helgeson

AU - Jennifer F. Helgeson

AU - Alyssa A. Leibold

DO - 10.6028/nist.sp.1261

PY - 2020

AB -

JA -

L2 - https://doi.org/10.6028/nist.sp.1261

U2 - 3091103665

ER -

TY - JOUR

TI - Economic Decision Guide Software (EDGe$) Online Tutorial: Wildfire Urban Interface (WUI) Case Study

AU - Jennifer F. Helgeson

AU - Peter J. Zhang

DO - 10.6028/nist.sp.1260

PY - 2020

AB - This report introduces features of the Economic Decision Guide Software (EDGe$) Online Tool V 1.0 and presents a fictitious case study of wildfire planning in the wildland-urban interface (WUI) based on publicly available real-world data. The case study highlights the competing interests of two neighboring communities by evaluating the same project alternatives from the point of view of each community. The WUI case study also demonstrates the importance of considering co-benefits and approaches to incorporating non-market valuation. The report presents a walkthrough of EDGe$ Online and closes with a discussion of implications from the presented case study and potential future research.

JA -

L2 - https://doi.org/10.6028/nist.sp.1260

U2 - 3091170451

ER -

TY - JOUR

TI - Fire risk assessment using the building fire safety engineering method

AU - Colleen Wade

AU - Peter Whiting

DO - 10.1177/104239159600800401

PY - 1996

AB - This paper describes a method of fire risk assessment known as the Building Fire Safety Engineering Method (BFSEM).The method has mainly been developed at Worcester Polytechnic Institute in the USA and is designed for use by persons with knowledge and experience of fire behavior and building construction. The main components of the method include evaluation of the probability of the fire self-terminating, probability of automatic suppression, and probability of manual suppression by a fire service. Factors affecting each of these components are discussed. The probabilities are combined to form an L-Curve describing the probability of limiting the fire to defined areas of the building. Comparison of L-Curves for different fire protection options forms the basis of the risk assessment.

JA - Journal of Fire Protection Engineering

L2 - https://doi.org/10.1177/104239159600800401

U2 - 2069547356

ER -

TY - JOUR

TI - ALARM 1.0: Decision Support Software for Cost-Effective Compliance With Fire Safety Codes | NIST

AU - Stephen F Weber

AU - Barbara C. Lippiatt

DO -

PY - 1994

AB -

JA -

L2 - https://www.semanticscholar.org/paper/907d7ddcfe85f02b556e8f64624c8f022052da8d

U2 - 2625422375

ER -

TY - JOUR

TI - ALARM 2.0 Users Manual: Minimizing Compliance Costs of the Life Safety Code for Prisons | NIST

AU - Stephen F Weber

AU - Laura I Schultz

DO - 10.6028/nist.ir.6807

PY - 2001

AB - ............................................................................................................................. iii Acknowledgments.............................................................................................................. iv 1.0 Introduction.................................................................................................................. 1 1.1 Purpose...................................................................................................................... 1 1.2 History ...................................................................................................................... 1 1.3 New Features ............................................................................................................ 1 1.4 Overview................................................................................................................... 2 2.0 Getting Started .............................................................................................................. 3 2.1 Installing ALARM 2.0................................................................................................ 3 2.2 Starting ALARM 2.0 .................................................................................................. 3 2.3 Help System.............................................................................................................. 4 3.0 Starting a Project.......................................................................................................... 7 3.1 Creating a New Project ............................................................................................. 7 Project Information ......................................................................................................... 7 3.2 Opening an Existing Project ..................................................................................... 9 4.0 Understanding the Project Window............................................................................ 11 4.1 Layout ..................................................................................................................... 11 4.2 Color Coding........................................................................................................... 12 5.0 Data Entry .................................................................................................................. 15 5.1 Selecting an Initial Level ........................................................................................ 15 5.2 Data Entry ............................................................................................................... 16 6.0 Finding the Least-Cost Improvement Plan ................................................................ 19 6.1 Optimizing .............................................................................................................. 19 6.2 The Report .............................................................................................................. 20 7.0 Technical Background: How ALARM Finds the Least Cost Plan............................. 23 7.1 Linear Programming ............................................................................................... 23 7.2 Modeling the Interdependencies ............................................................................. 24 7.3 The Zero-One Integer Programming Method ......................................................... 24 8.0 Safety Improvements and Cost Data........................................................................... 27 8.1 Safety Improvements .............................................................................................. 27 8.2 Cost Data................................................................................................................. 27 8.3 Cost Algorithms ...................................................................................................... 28 References......................................................................................................................... 29 Appendix A....................................................................................................................... 31

JA -

L2 - https://doi.org/10.6028/nist.ir.6807

U2 - 2676995917

ER -

TY - JOUR

TI - Validation of an Evacuation Model Currently Under Development

AU - M. Spearpoint

DO -

PY - 2013

AB - Current evacuation models have been found to have limitations either in the scope of their simulation, or the size of the scenario that can be simulated. A model currently under development called EvacuatioNZ was produced to address some of these limitations. EvacuatioNZ is a coarse network model that simulates the occupant movement times as well as the human behaviour before and during the evacuation process. It incorporates the Monte Carlo approach in producing probability distributions of evacuation times. This model is designed to allow the expansion or modification of the program as more knowledge on human behaviour and occupant emergency movement is obtained, without the need to reproduce the entire model. The main aim of this research was to assist in the development of this evacuation model by carrying out validation processes that tested the model's components. This would allow the model to be used with reasonable confidence by designers and fire engmeers. Individual component testing on the model has shown that the basic components of movement are working satisfactorily, and are producing results that are comparable to values produced by the Nelson and MacLennan flow equations. Tests using a combination of components have also been found to produce representative results, when similar assumptions are being used. However, more components, including the behavioural components, should be tested before this model can be used for design purposes. The current version of the program still has some limitations that need to be addressed in order to increase its functional value. Further research should also include the model validation using more calculation examples, as well as data from actual trial evacuations to validate the components of human behaviour in the model.

JA -

L2 - https://www.semanticscholar.org/paper/2309430da417505b45a73733963cdfed8d767446

ER -

TY - JOUR

TI - FIRE EVACUATION ANALYSIS OF THE MANCHESTER WOOLWORTHS FIRE USING NETWORK MODELLING

AU - Tetyana Morgun

DO -

PY - 2017

AB - Fire engineers are able to gather and learn a significant amount of information from previous incidents. Large fires, even though they can lead to tragic loss of life, provide insight into fire development and evacuee response. Simulations based upon a real-life scenario can be a useful tool when trying to understand how the fire affected the behaviour of the occupants and the choices they made. This research adopts a probabilistic network modelling methodology for building evacuation based on a real fire event. The aim of this research is to recreate a fire emergency evacuation from the Woolworths department store, applying the EvacuatioNZ egress model. The predominant research objective is to benchmark the capabilities of EvacuatioNZ and assist in its continuous development by evaluation of possible model limitations. The EvacuatioNZ software has been selected as a tool for this research, because it enables the user to consider random choices regarding exiting strategies to simulate probabilistic scenarios with a number of uncertainties.

JA -

L2 - https://www.semanticscholar.org/paper/b0ae5bccd0bf409cb69d18beac32e7bec1c8df85

ER -

TY - JOUR

TI - Validation of EvacuatioNZ Model for High-Rise Building Analysis

AU - Wei-Li Tsai

DO - 10.26021/2305

PY - 2007

AB - This thesis covers a variety of analytical approaches that validate the use of the EvacuatioNZ model on high-rise building analysis. Through performing a number of sensitivity analyses, several model deficiencies as well as functional limitations were improved upon and part of the model developments are continued based on the previous research done by two Masters students at the University of Canterbury. In this thesis, data from three evacuations were considered for different validating aspects. These evacuations were, a hypothetical 21-storey hotel building located in the United States of America, which was previously simulated using Simulex and EXIT89; a trial evacuation that was carried out in a 13-storey office building located in Canada; and a fire drill conducted at a 21-storey office building located in Australia. Overall, the results indicated that the EvacuatioNZ is able to produce reasonable predictions of the total evacuation time regardless of the number of floors involved. The component testing also showed satisfactory outcomes regarding the involvement of disabled occupants, complexity of node configurations, and different pre-movement time distributions. However, the current model still has a number of limitations that need to be verified and tested. These include the preferred route function and the connection problem for long stairs. Further research should also be carried out on the use of the Evacuation model on other types of building structures so as to increase the confidence level of utilizing the EvacuatioNZ model for general applications.

JA -

L2 - https://doi.org/10.26021/2305

U2 - 58135770

ER -

TY - JOUR

TI - A study on evacuation time from lecture halls in Faculty of Engineering, Universiti Putra Malaysia

AU - Wan Nur Asnida Wan Othman

AU - Mohd Zahirasri Mohd Tohir

DO - 10.1088/1755-1315/140/1/012096

PY - 2018

AB - An evacuation situation in any building involves many risks. The geometry of building and high potential of occupant load may affect the efficiency of evacuation process. Although fire safety rules and regulations exist, they remain insufficient to guarantee the safety of all building occupants and do not prevent the dramatic events to be repeated. The main objective of this project is to investigate the relationship between the movement time, travel speed and occupant density during a series of evacuation drills specifically for lecture halls. Generally, this study emphasizes on the movement of crowd within a limited space and includes the aspects of human behaviour. A series of trial evacuations were conducted in selected lecture halls at Faculty of Engineering, Universiti Putra Malaysia with the aim of collecting actual data for numerical analysis. The numerical data obtained during trial evacuations were used to determine the evacuation time, crowd movement and behaviour during evacuation process particularly for lecture halls. The evacuation time and number of occupants exiting from each exit were recorded. Video camera was used to record and observe the movement behaviour of occupants during evacuations. EvacuatioNZ was used to simulate the trials evacuations of DK 5 and the results predicted were compared with experimental data. EvacuatioNZ was also used to predict the evacuation time and the flow of occupants exiting from each door for DK 4 and DK 8.

JA -

L2 - https://doi.org/10.1088/1755-1315/140/1/012096

U2 - 2773884050

ER -

TY - JOUR

TI - Overview of Standards for Fire Risk Assessment

AU - Jr. John R. Hall

DO - 10.3210/fst.25.55

PY - 2006

AB - In the past decade, the world has seen the publication of a number of national, regional, and international standards and guides for fire risk assessment. In order to make sense of these diverse documents, it is useful to review their similarities and differences systematically. Some of these documents were discussed in detail in other presentations at this symposium. For the sake of efficiency, the general framework for describing fire risk assessment standards presented here is illustrated primarily by standards-making bodies or working groups headquartered in the U.S. Specifically, these documents are used as examples: • ISO TS 16732 • SFPE Guide to Fire Risk Assessment • NFPA 551 • ASTM E1776

JA - Fire Science and Technology

L2 - https://doi.org/10.3210/fst.25.55

U2 - 2116624730

ER -