Urban Fire Risk Assessment
Case Study Guimarães

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CONTENT

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Introduction

"Critical infrastructure is an asset or system which is essential for the ***maintenance of vital societal functions****. The damage to a critical infrastructure, its destruction or disruption by natural disasters, terrorism, criminal activity or malicious behaviour, may have a significant negative impact for the security of the EU and the well-being of its citizens."*

Main objective of EU:

- *Reduces the vulnerability of CI;*
- *Increasing their resilience.*

Introduction

The Great Fire of London, 1666

https://cdn.wionews.com/sites/default/files/2018/09/11/24039-untitled%25252520design%25252520%25252827%252529-20170616095738.png

Dhaka Fire, 2010

https://cdn.wionews.com/sites/default/files/2018/09/12/24044-untitled%25252520design%25252520%25252818%252529-20170616100330.png

Chiado, Portugal, 1988

https://media.timeout.com/images/105282812/1024/576/image.jpg

Introduction

Notre Dame Cathedral, 2019

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.usatoday.com%2Fstory%2Fnews%2Fworld%2F2019%2F04%2F16%2Fnotre-dame-cathedral-fire-conspiracy-theories%2F3486456002%2F&psig=AOvVaw1ZDDvr86SnCf0im3Nvj5AS&ust=1649238376718000&source=images&cd=vfe&ved=0CAoQjRxqFwoTCKCFh-7S_PYCFQAAAAAdAAAAABAD

National Museum of Brazil, 2018

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.nationalgeographic.com%2Fscience%2Farticle%2Fnews-museu-nacional-fire-rio-de-janeiro-natural-history&psig=AOvVaw1WGN0JTFQuUeRAJ1Zj4mtg&ust=1649238444290000&source=images&cd=vfe&ved=0CAoQjRxqFwoTCJD5ipLS_PYCFQAAAAAdAAAAABAN

Introduction

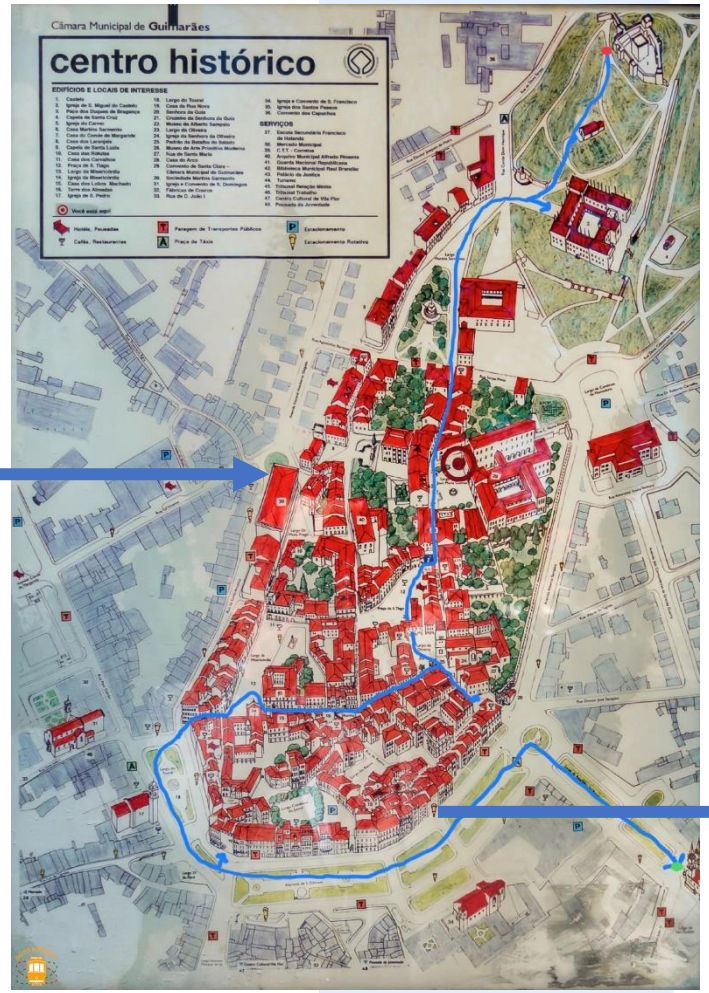
- Assessment of risk and vulnerability is especially desirable for old city centres:
  - There is a constant threat and the cause of a significant number of fatalities;
  - Loss of irreplaceable cultural heritage;
  - Buildings have a higher issue due to their materials and constructive characteristics;
  - Narrow street widths;
  - Proximity and shared walls between adjacent buildings;
  - High number of residents not prepared for extreme events.

Historic Centre of Guimarães

- Located in Northwest of Portugal, in province of Minho;
- City with a glorious past history, whose history is linked to the foundation of the Portuguese national identity and the Portuguese language in the century 13th - "Cradle of Portuguese nationality";
- The Historic Centre of Guimarães was classified by UNESCO - World Heritage (2001);
- European Capital of Culture in 2012;
- The population of Guimarães is one of the youngest in Europe.

https://www.google.com/url?sa=i&url=https%3A%2F%2Fominho.pt%2Fcentro-historico-de-guimaraes-e-patrimonio-mundial-ha-19-anos%2F&psig=AOvVaw3sy6HIxfBjxIsY9VVlp571&ust=1649239312341000&source=images&cd=vfe&ved=0CAoQjRxqFwoTCKjPza7V_PYCFQAAAAdAAAAABAD

Historic Centre of Guimarães



Urban Fire Risk Assessment

1. Criticality Survey;
2. Fire Risk Assessment;
3. Mapping the Fire Risk Indexes;

Urban Fire Risk Assessment

1. **Criticality Survey;**
2. Fire Risk Assessment;
3. Mapping the Fire Risk Indices;

QUESTIONARIO

Data: Escolha a data aqui.

1) Dados pessoais

Nome	Escreva seu nome aqui		
Sobrenome	Escreva seu sobrenome aqui		
Idade	Escreva sua idade aqui	Sexo	Selecione aqui.
E-mail	Escreva o endereço aqui.		
Telefone	Escreva o número aqui.		
Setor de atividade	Escreva aqui seu setor de atividade.		
Subsetor de atividade	Escreva aqui seu subsetor de atividade.		

2) Interdependências dos setores e subsetores de interesse

- Para cada um dos setores e/ou subsetores do qual depende, refira qual é a informação que considera relevante recolher, para poder avaliar melhor a sua resiliência organizacional, tendo em conta os atributos e dimensões referidos no Quadro 1 do Anexo 1.

Setor	Subsetor	Informação que considera relevante
Água	Tratamento de água	Escreva aqui a informação que considera relevante recolher.
Informação e Telecomunicações	Informação	Escreva aqui a informação que considera relevante recolher.
Energia	Gas Natural	Escreva aqui a informação que considera relevante recolher.
Transporte	Serviços postais	Escreva aqui a informação que considera relevante recolher.
Outro	Outro	Escreva aqui a informação que considera relevante recolher.

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Urban Fire Risk Assessment

1. Criticality Survey;
2. **Fire Risk Assessment;**

Fire Risk Index was assessed by ARICA method, is composed by two main factors:

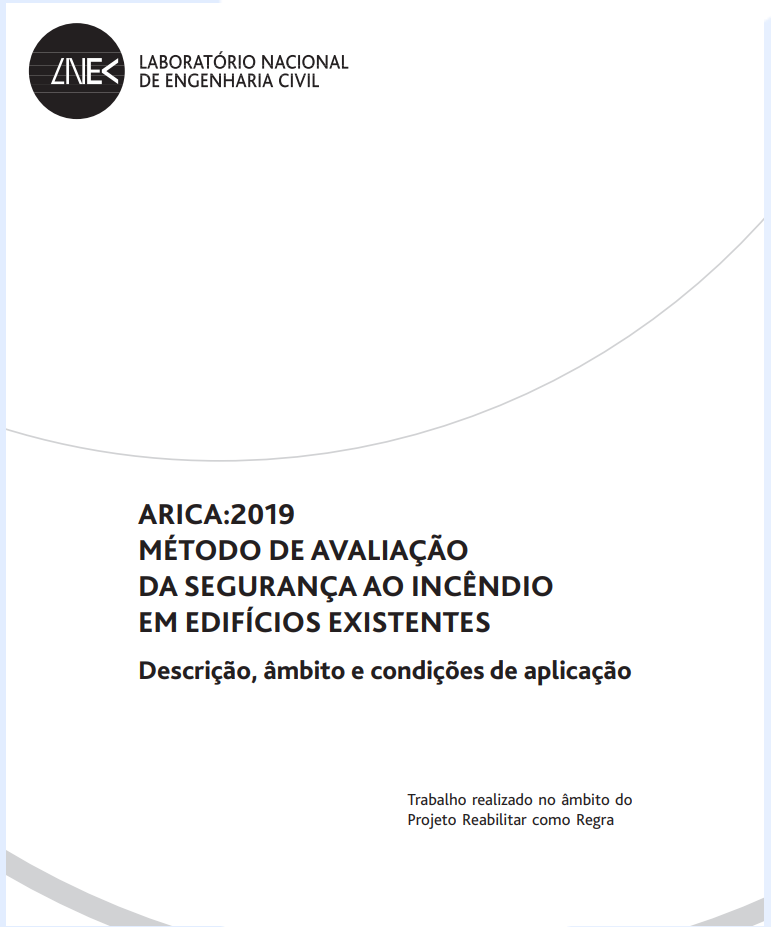
- Global Risk Factor → divided in: Fire ignition phase; Fire propagation phase; Building evacuation phase.
- Global Efficiency Factor → Combat Phase

Urban Fire Risk Assessment

1. Criticality Survey;

2. **Fire Risk Assessment: Arica 2019 Method**

- ARICA Method calculates an index that reflects the level of fire safety of a building, enclosure, or part of these, with reference to the building regulations in force.
- The method was originally developed at LNEC in 2004.
- The 2019 version resulted from a work of reformulation and improvement in order to make the method more rigorous and easy to apply.



Urban Fire Risk Assessment

1. Criticality Survey;
2. **Fire Risk Assessment: Arica 2019 Method**

- The values assigned to each partial factor depend on the concrete conditions in which the buildings are located;
- The values of the partial factors have different origins, being in some cases originated from expressions developed for effect, while the others are tabulated;
- The onset of fire depends on several aspects. However, those with greater incidence involve technical installations (electricity and gas), the state of building conservation, and the nature of fire loads, which correspond to the partial factors.
- The global risk factor is obtained based on the arithmetic mean of these four factors.

Global Factors		Partial Factors
RI	At the beginning of the Fire	State of conservation of the construction- A1
		Electrical installations – A2
		Gas installations – A3
		Nature of Fire Loads – A4
	Development and Propagation of Fire in the Building	Fire Loads - B1
		Fire compartmentation - B2
		Fire detection, alarm, and alert - B3
		Securityequipment - B4
		Distance between overlapping spans (B5)
	Building evacuation	Factors inherent to evacuation paths - C1
		Building inherent factors - C2
		Correction factors – C3
Efficiency	Firefighting	Interior firefighting factors in the building (D2)
		Safety teams (D3)

Urban Fire Risk Assessment

1. Criticality Survey;
2. **Fire Risk Assessment: Arica Method**

- The CCI's global fire risk factor value corresponds to the four global risk factors (fire-starting, development and spread, building evacuation, and fire fighting), increasing the first two factors by 1.20, 1.10;

Global Risk Factor	Factors Weight
Fire starting	1.20
Development and propagation	1.10
Evacuation of the Building	1.00
Firefighting	1.00

- The fire risk of the building is obtained by the quotient of the building's overall fire risk factor and the reference risk factor;

- The reference risk factor is obtained by the product of the reference values of each partial factor, associating these four partial factors with their respective weights. The arithmetic means of these four reference factors provide the reference risk factor.

	Use Type	
Expression of the risk factor of reference	Normal use	Industrial buildings, warehouses, libraries, and files.
	0.915+0.25*Fc	1.11+0.25*Fc

Fc corresponds to the partial correction factor

Urban Fire Risk Assessment

1. Criticality Survey;
2. Fire Risk Calculation sheet;
3. **Mapping the Fire Risk Indexes;**

Work in Development

1. Predictive Models – Bayesian Networks;
2. Vulnerability Index;
3. Correlation and simulation models.

Thanks for Your Attention

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