TECHNICAL REPORT

ISO/TR 5202

First edition
2023-06

Buildings and civil engineering works — Building resilience strategies related to public health emergencies — Compilation of relevant information

Reference number
ISO/TR 5202:2023(E)

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Published in Switzerland

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Foreword

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This document was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Looking back at the history of building design, improvements have sometimes been driven by epidemics, such as the 19th century cholera outbreak in London, which led to a greater emphasis on ventilation and the use of dense, easy-to-clean materials such as tiles rather than carpets[1]. After the 1918 flu pandemic, guest bathrooms were added to residences to reduce exposure and infection risk[2].

Improvements are still required in public health emergencies of the 21st century where buildings based on current design standards show inadequate adaptability. In COVID-19, for example, large numbers of densely populated public buildings such as schools, offices, malls were forced to close due to high risk of infection. Even in homes the risk of infection still existed. Medical facilities could not bear the sudden increase in infectious patients, and some sports stadiums, exhibition halls, etc., were transformed into temporary hospitals. In face of these challenges, a number of improvements have already appeared in some cases, as well as in some guidelines, standards and studies by relevant international, national, and regional organizations and institutions.

This document collects the challenges posed by the epidemic to built environment and the corresponding adaptation solutions during 21st century public health emergencies, particularly COVID-19, to provide a reference for resilience design of built environment to adapt to future changing environment.

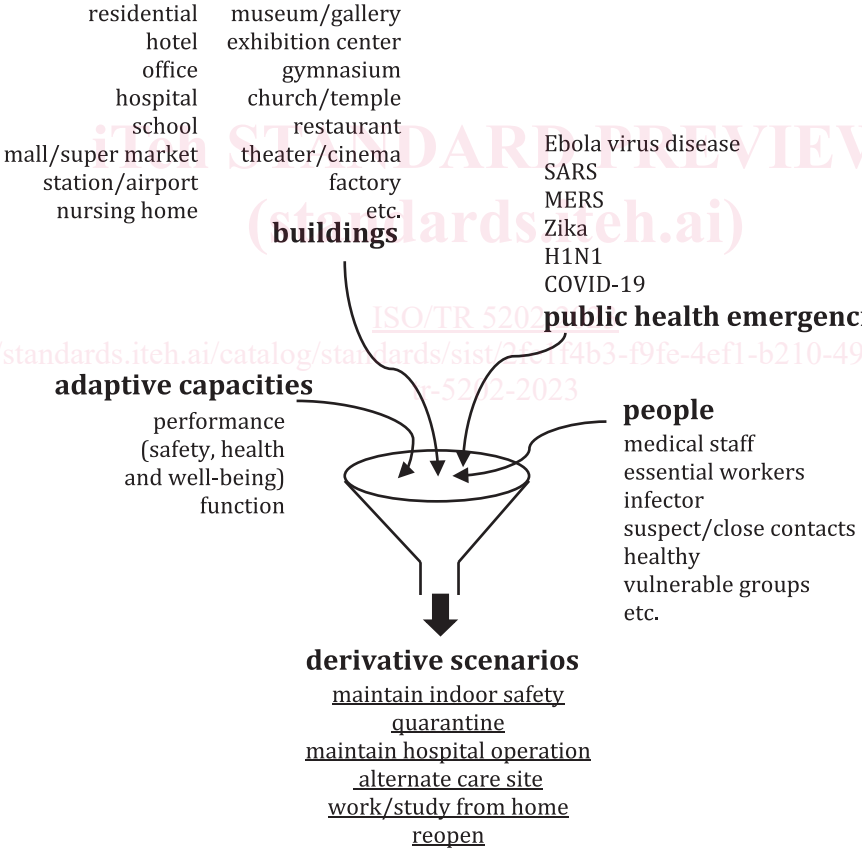


Figure 1 — Generation of derivative scenarios

For better comprehension, this document categorizes the challenges and solutions in terms of six typical derivative built environment scenarios during the pandemic, including maintaining indoor safety, quarantine, maintaining hospital operation, alternate care site, working/studying from home, and reopening. These six scenarios are informed by an information search based on combinations of such key words as different population groups, building types, public health emergencies and adaptive capacities (see Figure 1).

The document is helpful to stakeholders including end-users, investors, authorities, standards developing organisations, specialists (engineers, architects, etc.), manufacturers and builders, as well as other parties involved in public health emergencies, such as public health administrators, medical staff.

Buildings and civil engineering works — Building resilience strategies related to public health emergencies — Compilation of relevant information

1 Scope

This document provides a compilation of relevant information on building resilience strategies in response to public health emergencies, including:

— challenges of public health emergencies on built environment;

— resilience strategies to meet the challenges;

excluding:

— emergency operations;

— personnel organization and management.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
resilience
adaptive capacity of an organization in a complex and changing environment

[SOURCE: ISO Guide 73:2009, 3.8.1.7]

4 Concept

4.1 Resilience

Buildings with a service life of decades or even hundreds of years can encounter challenges that were not anticipated when they were designed. Resilience of built assets can reduce losses in the future complex and changing environment.

4.2 Public health emergencies

Expressions of public health emergency vary in different contexts. They are generally described as the events that seriously affect public health. Table 1 lists some typical expressions.

Table 1 — Expressions of public health emergency

Expressions	Description	Source
Public health risk	A likelihood of an event that can affect adversely the health of human populations, with an emphasis on one which can spread internationally or can present a serious and direct danger	International health regulations (2005) [4] WHO
Public health emergency of international concern	An extraordinary event which is determined, as provided in these regulations: — to constitute a public health risk to other states through the international spread of disease and — to potentially require a coordinated international response	
Public health emergency	Outbreaks of major infectious diseases, group diseases of unknown origin, major food and occupational poisoning and other events seriously affecting public health that occur suddenly and cause or are likely to cause serious harm to public health	Regulations on emergency response to public health emergencies [5] China
	An emergency need for health care services to respond to a disaster, significant outbreak of an infectious disease, bioterrorist attack, or other significant or catastrophic event	National disaster medical system memorandum of agreement among the departments of homeland security, health and human services, veterans affairs, and defense [6] United States

5 Derivative scenarios

There are six typical derivative scenarios for built environment during 21st century public health emergencies:

— maintain indoor safety

— quarantine

— maintain hospital operation

— alternate care site

— work/study from home

— reopen

NOTE 1 Quarantine at designated places and home are effective control measures to separate suspected patients from the general population.

NOTE 2 Alternate care sites that are temporarily constructed or converted from exhibition centre, gymnasium, etc., can supplement existing medical facilities to a certain extent.

NOTE 3 In a prolonged public health emergency, people must work or study at home for a long time.

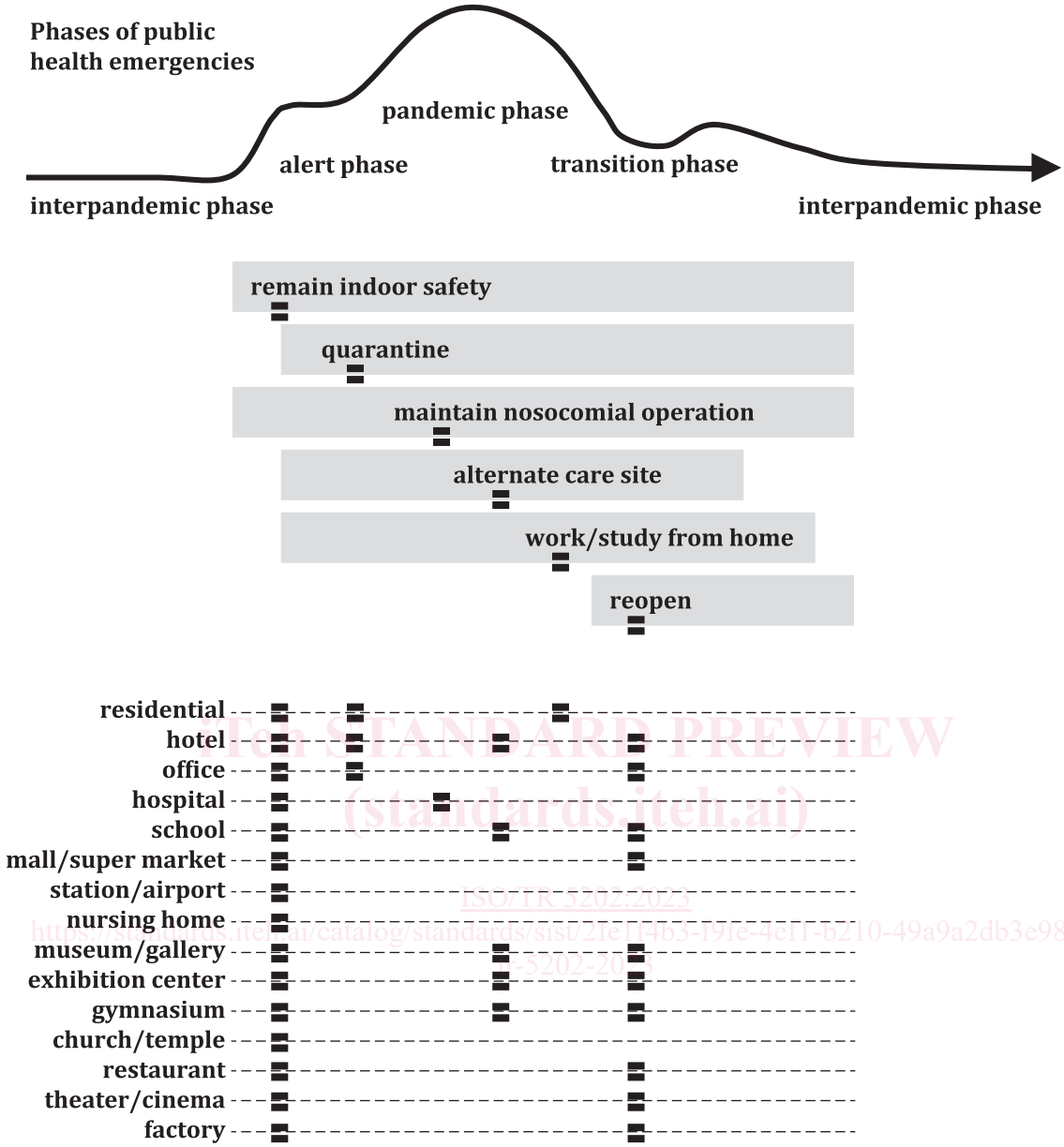
NOTE 4 Buildings that have been closed for a long time must ensure the safety and health of their occupants when reopen.

Table 2 shows the derivative scenarios emerged in typical public health emergencies of 21st century.

Table 2 — Derivative scenarios in typical public health emergencies of 21st century[7][8]

Public health emergencies	Year of breakout	Derivative scenarios					
		Maintain indoor safety	Quarantine	Maintain hospital operation	Alternate care site	Work/study from home	Reopen
Ebola virus disease	2014	√	√	√	√		
Zika	2016	√	√	√	√		
MERS	2012	√	√	√			
SARS	2003	√	√	√	√	√	√
H1N1	2009	√	√	√			
COVID-19	2019	√	√	√	√	√	√

At different phases of public health emergencies, different types of building can experience different derivative scenarios (one type of building can experience one or more scenarios) (See Figure 2). This document summarizes the challenges in different derivative scenarios (see Clause 6) and resilience strategies to deal with them (see Clause 7).



NOTE The phases of public health emergencies are adapted from the "continuum of pandemic phases" of WHO[9].

Figure 2 — Typical derivative scenarios in different types of buildings in different phases of public health emergencies

6 Challenges

6.1 General

Unlike earthquakes and climate change, in derivative scenarios of public health emergencies, buildings can not be damaged, but their performance and functionality can be inadequate, resulting in impacts on safety, health and well-being of users.

This clause summarizes the challenges in each typical scenario (see Clause 5) and lists some examples. Infection risks exist in each scenario. Infection risks in work/study from home and reopen scenarios are the same as in maintaining indoor safety (see 6.2) and are therefore not elaborated again. Quarantine, maintaining hospital operation, and alternative care site scenarios have more specific infection