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Security and resilience — Guidelines for hardened protective shelters

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durcis*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 292, *Security and resilience*.

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.

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Introduction

0.1 General

This document provides guidelines for hardened protective shelters used for protection of people, assets, and functions supporting critical infrastructures during a disaster through isolating them from the hazardous environment and thus protecting them against the dangerous effects of the hazard.

Protection of people is based on international treaties and protection of the civilian population when their country is at war, but also in peacetime is primordial. Article 3 of the United Nations Universal Declaration of Human Rights^[2] gives everyone the right to life, liberty, and security. Furthermore, the fourth treaty of the Geneva Convention^[1] proclaims the civilian populations right to be protected in armed conflicts.

0.2 Hazards and disasters

Hazards create harmful effects such as loss of life, injury or other health effects, property damage, social and economic disruption or environmental degradation. Hazards can be single, sequential or combined in their origin and effects, as hazardous events can occur alone, simultaneously, cascading or cumulatively.

If the hazard(s) cannot be mitigated, they can result in a disaster. During a disaster, citizens typically need some type of societal protection against the effects of the hazard. Most societies have planned and implemented actions to protect their citizens against hazards and their effects. These actions are sometimes referred to diversely as civil protection, civil defence, crisis management, emergency management, emergency preparedness, contingency planning, civil contingency and civil aid.

The preventive measures and protective efforts depend on the threat assessments studying the risks created by various hazards or combinations of them. The threat assessments usually address all four stages of the disaster management cycle (mitigation, preparation, response and recovery).

When a hazard occurs, it can cause effects that can affect the citizens. The citizens can be directly injured or harmed by the failure of critical infrastructure and the denial of vitally important functions of the society. This document focuses only on hazards and effects that can be mitigated through hardened protective shelters. Some other common and well-known methods to protect citizens are mass evacuations, quarantines and redundant systems.

0.3 Hardened protective shelter

A hardened protective shelter is a purpose-built structure, which is blast resistant (designed to withstand the effects of a blast with a predefined force) and gastight (so completely closed that no gases can get in or out), for protection of shelter occupants against the effects of disasters by isolating them from the hazardous environment.

The shelter is hardened against the mechanical effects of disasters by means of a heavily reinforced concrete or bedrock shield. This distinguishes it from rapidly erected temporary shelters such as lightweight canvas weather shelters, other tarp tent shelters as well as metal and container shelters.

The shelter can sustain the life of the occupants for an extended period of time should the anticipated threat so require, by maintaining a sufficient internal overpressure and using purified filtered air to prevent entry of all possible toxic substances that the ambient air can contain.

0.4 Use of shelters

The civil protection shelter programs are managed by civilian authorities. The primary purpose of hardened protective shelters is to protect citizens against the effects of weapons during wars or warlike situations, but they can also be used for safeguarding them in case of natural hazards or industrial accidents threatening civilian life.

Military shelters are usually hardened against weapon effects, such as blast, chemical, biological, radiological and nuclear (CBRN) warfare, and in many cases also against the effects of an electromagnetic pulse (EMP). They are used as command-and-control centres, for protection of troops and as fortified hangars for aircraft and other military assets.

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There are several industry branches with a potential risk of accidents involving of flammable, explosive, poisonous or radiating materials. The accident is often caused by an explosion, but also natural effects such as flooding, or earthquake can trigger an incident. The industrial market segment comprises, among others, chemical industries, nuclear power plants, hospitals, industrial command and control centres and data storage facilities.

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Security and resilience — Guidelines for hardened protective shelters

1 Scope

This document provides guidelines for the design, use and maintenance of hardened protective shelters (hereafter referred to as “shelters”). It specifies guidance on the layout, structures, equipment and actions related to a shelter.

This document is intended for organizations or individuals responsible for or involved in decision-making, planning, implementation, administration, use or upkeep of shelters, such as local, regional and national governments, civil protection agencies, first responders and businesses such as designers, constructors and equipment suppliers.

This document does not cover the minimum requirements or exact specifications for the properties of or actions related to a shelter; nor does it cover rapidly erected temporary shelters, such as lightweight canvas weather shelters, other tarp tent shelters, or metal and container shelters. Military shelters are subject to additional requirements which are outside the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 22300, *Security and resilience — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22300 and the following 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

blast resistant

withstanding the effects of a blast with a predefined force

3.2

gastight

preventing gas from entering or escaping

3.3

hardened protective shelter

blast resistant (3.1) and *gastight* (3.2) facility with a capability to maintain internal overpressure with air purified from toxic agents

3.4

normal time

period during which there is no such crisis that would cause the shelter to be activated as during crisis time use

4 Design of a shelter

4.1 Design process

The design of a shelter should be based on operational requirements, depending on the purpose of the shelter and the applicable threat scenario(s). The design process of a shelter is practically similar to that of any capital project. The entire design process from the first conceptual idea to the beginning of construction is presented as a flowchart in [Figure 1](#).

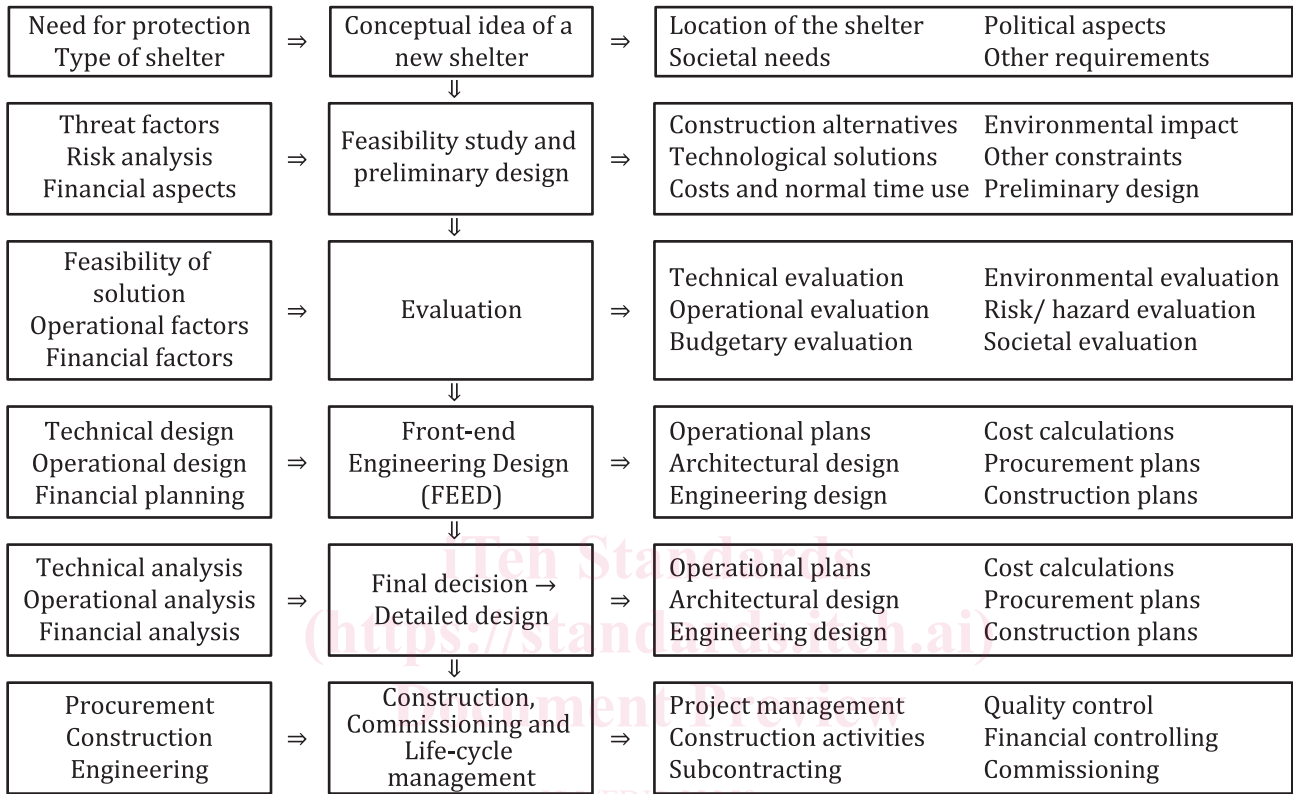


Figure 1 — Design process of a shelter

The operational, architectural and engineering design is described in detail in [Figure 2](#).

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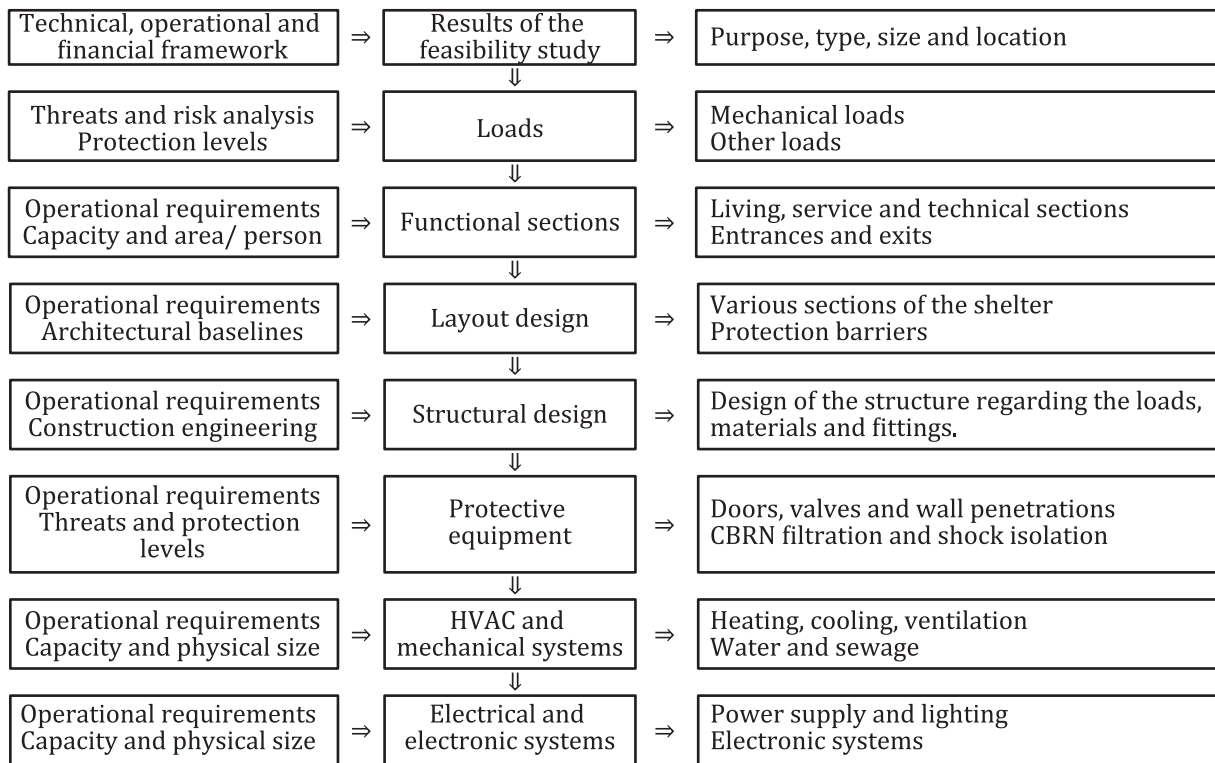


Figure 2 — Detailed design process of a shelter

4.2 Design criteria

4.2.1 Hazards

A shelter gives protection against various effects of external hazards. [Table 1](#) gives examples of hazards, against which the shelter can offer effective protection. [22359](#)

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Table 1 — Hazards and examples of their origins

Hazard	Examples of origin of the hazard
Human-caused hazards (intentional malevolent actions)	War Terrorist act Civil disturbance Sabotage
Technological hazards (accidents or failures of systems and structures)	Industrial accident Transport accident Storage accident Nuclear power plant accident
Natural hazards (acts of nature)	Volcanic eruptions Extreme storms Asteroids, meteorites Solar flares

The effects of hazards can be either mechanical loads caused by various physical forces exerted on the shelter (see [4.4.1](#)) or other effects caused by various toxic agents, radiation or thermal energy (see [4.7.6](#)).