First edition
2020-01

Sustainability in buildings and civil engineering works — Design for disassembly and adaptability — Principles, requirements and guidance

Développement durable dans les bâtiments et ouvrages de génie civil — Conception pour la démontabilité et l'adaptabilité — Principes, exigences et recommandations

Reference number
ISO 20887:2020(E)

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Published in Switzerland

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Foreword

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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 documents 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 59, *Buildings and civil engineering works*, Subcommittee SC 17, *Sustainability in 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

Applying the principles of design for disassembly and adaptability (DfD/A) to the service life planning of buildings and civil engineering works can make a positive contribution to sustainable development. While service life planning is a design process that seeks to ensure that the service life of a constructed asset will equal or exceed its design life, design for disassembly and adaptability is a strategy to optimize both the service life and the design life. The strategy does not suggest overbuilding to meet a vast number of unknowns that a constructed asset might encounter.

Introducing aspects of design for disassembly can be used to reduce and/or prevent waste and increase resource efficiency by encouraging alternative considerations at the project definition phase. The application of adaptability concepts and principles can minimize the need for unnecessary removal and new construction, by repurposing or modifying constructed assets to renew their service life, and result in constructed assets that are able to accommodate a larger variety of uses. From a broader perspective, the recovery and subsequent reuse or recycling of disassembled construction materials and components will support the evolving concept of a circular economy.

The design and construction industry has often trusted/depended upon traditional assembly methods, products, and processes that typically do not consider deconstruction. As such, during a renovation or demolition project, products and materials are often not easily salvaged for reuse, recycling or energy recovery, and therefore, become waste that is landfilled.

Incorporating DfD/A concepts early in the planning and design phase will increase the likelihood that activities during the stages of use, maintenance (including repair, replacement, refurbishment), and end-of-life (e.g., disassembly, reuse, recycling, disposal) will be conducted more efficiently from a total resource perspective (i.e., time and associated costs, labour costs, materials, and energy).

Design for disassembly devises explicit methods, prior to construction, for optimal recovery of specific products and materials without damaging either that which is being removed or surrounding components. The adaptability aspects of DfD/A support the continued use of constructed assets by allowing for and accommodating substantial change (e.g., demographics, social, economic, and technological conditions and physical surroundings and needs) within an existing or expanded physical asset. Designing for adaptability means designing for both present and future uses, encouraging the use of phased developments and matching supply with demand in a timely fashion. The decision to use these methods is usually considered in conjunction with the investment rate of return over time and risk.

Successful application of DfD/A principles will require their integration into the early phases of a project, when it is still cost-effective to do so. Implementation of DfD/A will require compromises and trade-offs to make choices that can be constrained by factors such as technical complexity, lack of resources and time, risk of obsolescence and limited information on costs or relative environmental burdens over the total life cycle. Therefore, it is important that all parties involved in the design, product supply, construction, commissioning, operation and decommissioning aspects have sufficient knowledge and understanding to implement the intended results. Designers have the major role in considering DfD/A to facilitate the best technical, economic and environmental opportunities. Clients often drive the design team to consider and implement DfD/A elements within a project. The supporting supply chain, including product suppliers, constructors, facility managers and those decommissioning constructed assets also need to adapt their approaches to optimize the design intentions which relate to DfD/A.

This document is intended to provide a framework of the DfD/A principles and the key issues that should be considered by the different actors, particularly designers involved in the project. It is equally important that this knowledge base is continually added to by those implementing these principles, and associated activities, for example, by knowledge sharing through the creation of case studies and associated journal articles.

This document is one in a suite of documents dealing with sustainability in construction works that includes the following, in addition to this document:

a) ISO 15392, *Sustainability in buildings and civil engineering works — General principles*;

b) ISO/TS 12720, *Sustainability in buildings and civil engineering works — Guidelines on the application of the general principles in ISO 15392*;

c) ISO/TR 21932, *Sustainability in buildings and civil engineering works — A review of terminology*;

d) ISO 21929-1, *Sustainability in building construction — Sustainability indicators — Part 1: Framework for the development of indicators and a core set of indicators for buildings*;

e) ISO/TS 21929-2, *Sustainability in building construction — Sustainability indicators — Part 2: Framework for the development of indicators for civil engineering works*;

f) ISO 21931-1[1)], *Sustainability in building construction — Framework for methods of assessment of the environmental performance of construction works — Part 1: Buildings*;

g) ISO 21931-2, *Sustainability in buildings and civil engineering works — Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment — Part 2: Civil engineering works*;

h) ISO 16745-1, *Sustainability in buildings and civil engineering works — Carbon metric of an existing building during use stage — Part 1: Calculation, reporting and communication*;

i) ISO 16745-2, *Sustainability in buildings and civil engineering works — Carbon metric of an existing building during use stage — Part 2: Verification*;

j) ISO 21930, *Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services*;

k) ISO 21678[2)], *Sustainability in buildings and civil engineering works — Indicators and benchmarks — Principles, requirements and guidelines*.

This document deals with environmental, social and economic aspects of sustainability. The relationship among the suite of documents is elaborated in Figure 1.

1) Revision under preparation.

2) Under preparation. Stage at the time of publication: ISO/FDIS 21678:2020.

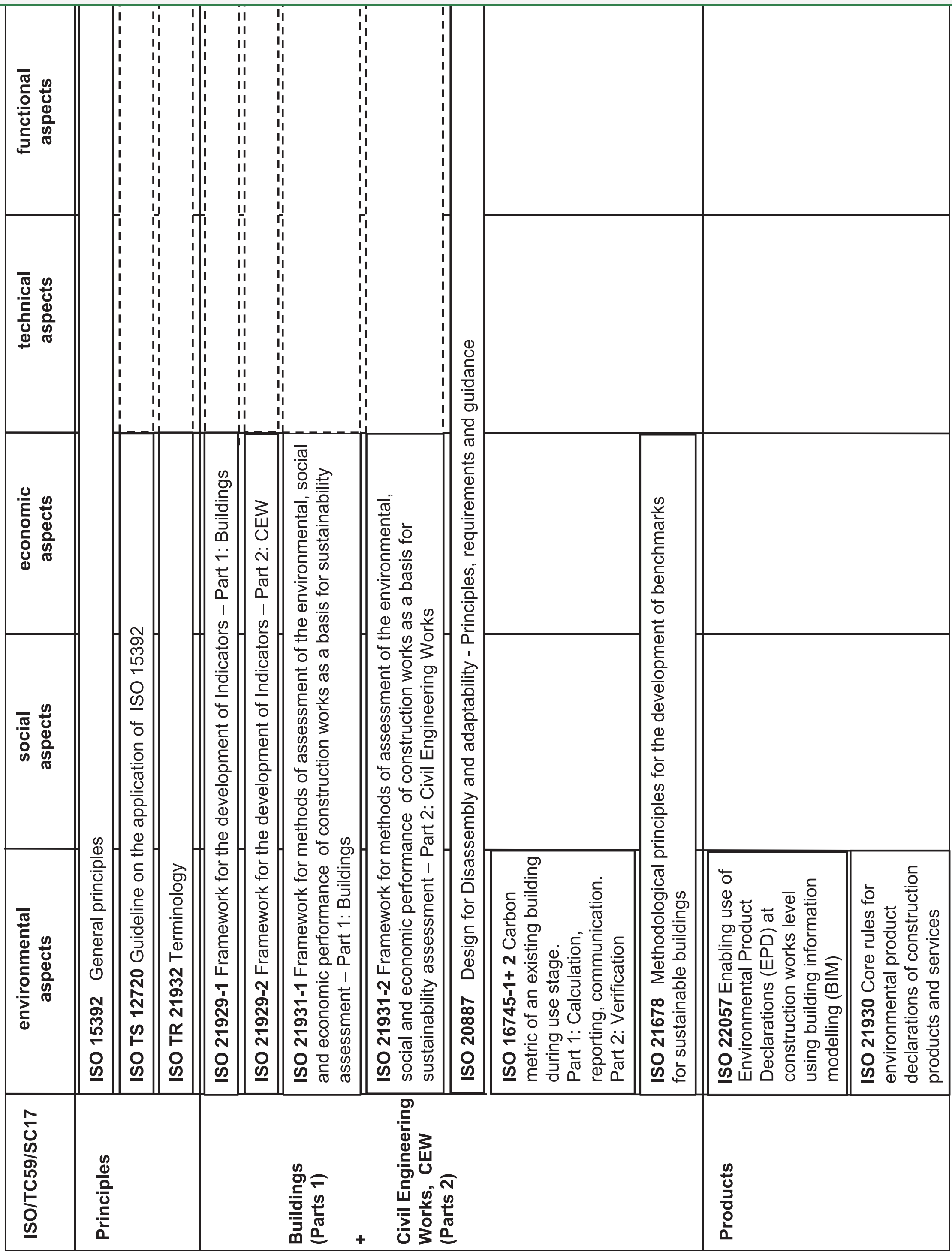
ISO/TC59/SC17
environmental aspects
social aspects
economic aspects
technical aspects
functional aspects
Principles
ISO 15392 General principles
ISO TS 12720 Guideline on the application of ISO 15392
ISO TR 21932 Terminology
Buildings (Parts 1)
+
Civil Engineering Works, CEW (Parts 2)
ISO 21929-1 Framework for the development of Indicators – Part 1: Buildings
ISO 21929-2 Framework for the development of Indicators – Part 2: CEW
ISO 21931-1 Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment – Part 1: Buildings
ISO 21931-2 Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment – Part 2: Civil Engineering Works
ISO 20887 Design for Disassembly and adaptability - Principles, requirements and guidance
ISO 16745-1+ 2 Carbon metric of an existing building during use stage. Part 1: Calculation, reporting, communication. Part 2: Verification
ISO 21678 Methodological principles for the development of benchmarks for sustainable buildings
Products
ISO 22057 Enabling use of Environmental Product Declarations (EPD) at construction works level using building information modelling (BIM)
ISO 21930 Core rules for environmental product declarations of construction products and services

Figure 1 — Suite of related documents for sustainability in buildings and civil engineering works

