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Sustainability in buildings and civil engineering works — Sustainability indicators —

Part 2: Framework for the development of indicators for civil engineering works

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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 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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*.

This first edition cancels and replaces ISO/TS 21929-2:2015, which has been technically revised.

The main changes are as follows:

— ~~—~~new indicators are provided;

— ~~—~~core and additional indicators and some specific indicators for different typologies of CEW are listed in Annex A~~Annex A;~~;

— ~~—~~the relationship between the indicators and United Nations SDGs (Sustainable Development Goals) is addressed.

A list of all parts in the ISO 21928 series can be found on the ISO website.

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

This document describes and provides guidelines for the development of sustainability indicators related to civil engineering works and defines the aspects and impacts of civil engineering works to consider when developing systems of sustainability indicators.

These guidelines form a basis for the suite of ISO/TC 59/SC 17 standards intended to address specific issues and aspects of sustainability relevant to civil engineering works. The issue of sustainable development is broad and of global concern and, as such, involves all communities and ~~interested parties.~~stakeholders. Both current and future needs define the extent to which economic, environmental and social aspects are considered in a sustainable development process.

The built environment (buildings and civil engineering works) is a key element in determining quality of life and contributes to cultural identity and heritage. As such, it is an important factor in the appreciation of the quality of the environment in which people live and work.

The built environment is highly important for sustainable development because:

— ~~—~~it is a key sector in national economies;

— ~~—~~it has a significant impact on poverty reduction through the provision of improved basic economic and social services within the built environment;

— ~~—~~it is one of the single largest industrial sectors and, while providing value and employment, it uses considerable resources and contributes to the transformation of areas, with consequential impacts on economic and social conditions and the environment;

— ~~—~~it represents a significant share of the economic assets of individuals, organizations and nations, providing societies with their physical and functional environment;

— ~~—~~it has considerable opportunity to show improvement relative to its economic, environmental and social impacts.

While the challenge of sustainable development is global, the strategies for addressing sustainability in civil engineering works are essentially local and differ in context and content from region to region. These strategies reflect the context, the preconditions and the priorities and needs, not only in the built environment, but also in the social environment. This social environment includes social equity, cultural issues, traditions, heritage issues, human health and comfort, social infrastructure and safe and healthy environments.

In addition, these strategies can include poverty reduction, job creation, access to safe, affordable and healthy shelter, and loss of livelihoods. These aspects are closely related to the United Nations Sustainable Development Goals (SDG). For this reason, in Annex D~~Annex D,~~ the relation of the provided indicators to these SDG is shown.

This document defines a framework for the development of sustainability indicators for civil engineering works based on the premise that civil engineering works contribute to improving the economic, social and environmental aspects at local, regional and global levels with minimum adverse impact. This document follows the general principles presented in ISO 15392.

Indicators are figures or other qualitative or descriptive measures that enable information on a complex phenomenon, such as, environmental impact, to be simplified into a form that is relatively easy to use and understand.

The four main functions of indicators are quantification, simplification, communication and decision making. Changes in a civil engineering works over time and the development of changes in relation to stated objectives and targets should be monitored with the help of indicators.

When developing and selecting indicators, the starting point is the identification of the main users and user needs. Sustainability indicators for civil engineering works are needed in decision-making by several ~~interested parties~~stakeholders, such as:

— ~~—~~public bodies and policy makers;

— investors, owners and promoters;

— planners, developers and designers;

— governmental and non-governmental organizations (considering interest groups both at national and at local level);

— manufacturers of products;

— contractors;

— operators and maintainers;

— users and other stakeholders who are given service by the infrastructure; and

— local residents.

An example of utilization of indicators for decision support in the selection of alternatives is provided in Annex E~~Annex E.~~.

Sustainability indicators, as well as sets and systems of indicators, for the specification, assessment and representation of the contribution of a civil engineering works to sustainable development can be used in many ways. For example, among others, their application can support the following:

— design and decision-making process(es) during the planning and design stage of a civil engineering works (e.g. incorporation in the design of sustainable material, technologies, processes and other components);

— development and application of assessment methods and certification systems;

— specification and verification of environmental and social requirements in the context of procurement;

— indicating the civil engineering performance (e.g. marketing);

— measuring, monitoring or evaluating the performance and achievement of sustainability objectives over the different life cycle stages of the civil engineering works;

— identifying critical trends, both positive and negative, in the development and operation of civil engineering works;

— accepting responsibility for impacts on the environment and the society;

— representation of activities and results in the context of responsibility towards the economy, environment and society (e.g. sustainable development reporting).

NOTE The monitoring and evaluation of objectives can contribute to the continual improvement related to a specific or group of civil engineering works.

Aspects and impacts are the basis of the framework for the development of sustainability indicators for assessing the sustainability performance of new or existing civil engineering works, related to their design, construction, operation, maintenance, refurbishment and end-of-life. The indicators developed from these sets of aspects and impacts provide measures to express how the performance of a civil engineering works contributes to sustainability and sustainable development. The indicators developed based on these sets represent aspects of civil engineering works that potentially impact on issues of concern related to sustainability and sustainable development.

The object of consideration in this document is a civil engineering works, a part of the civil engineering works or a combination of several civil engineering works.

This document is one in a suite of International standards dealing with sustainability in buildings and civil engineering works, which includes ISO 15392, ISO 21929-1, ISO 21930, ISO 21931-1, ISO 21931-~~-~~2,

along with the terminology of sustainability in buildings and civil engineering works defined by ISO/TR 21932. The relationship among these International standards is shown in Figure 1~~Figure 1.~~

ISO/TC 59/SC 17	Environmental aspects	Social aspects	Economic aspects	Technical aspects	Functional aspects
Principles	**ISO 15392** General principles				
	ISO/TS 12720 Guidelines on the application of ISO 15392				
	ISO/TR 21932 A review of terminology				
Buildings (Parts 1) **+** **Civil engineering works, CEW (Parts 2)**	**ISO 21929-1** Framework for the development of indicators – Part 1: Buildings				
	ISO 21928-2 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 Indicators and benchmarks – Principles, requirements and guidelines				
Products	**ISO 22057** Data templates for the use of environmental product declarations (EPDs) for construction products in building information modelling (BIM)				
	ISO 21930 Core rules for environmental product declarations of construction products and services				

ISO/TC 59/SC 17	Environmental aspects	Social aspects	Economic aspects	Technical aspects	Functional aspects
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	ISO/TR 21932 A review of terminology				
Buildings (Parts 1) **+** **Civil engineering works, CEW (Parts 2)**	**ISO 21929-1** Framework for the development of indicators – Part 1: Buildings				
	ISO 21928-2 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 Indicators and benchmarks – Principles, requirements and guidelines				
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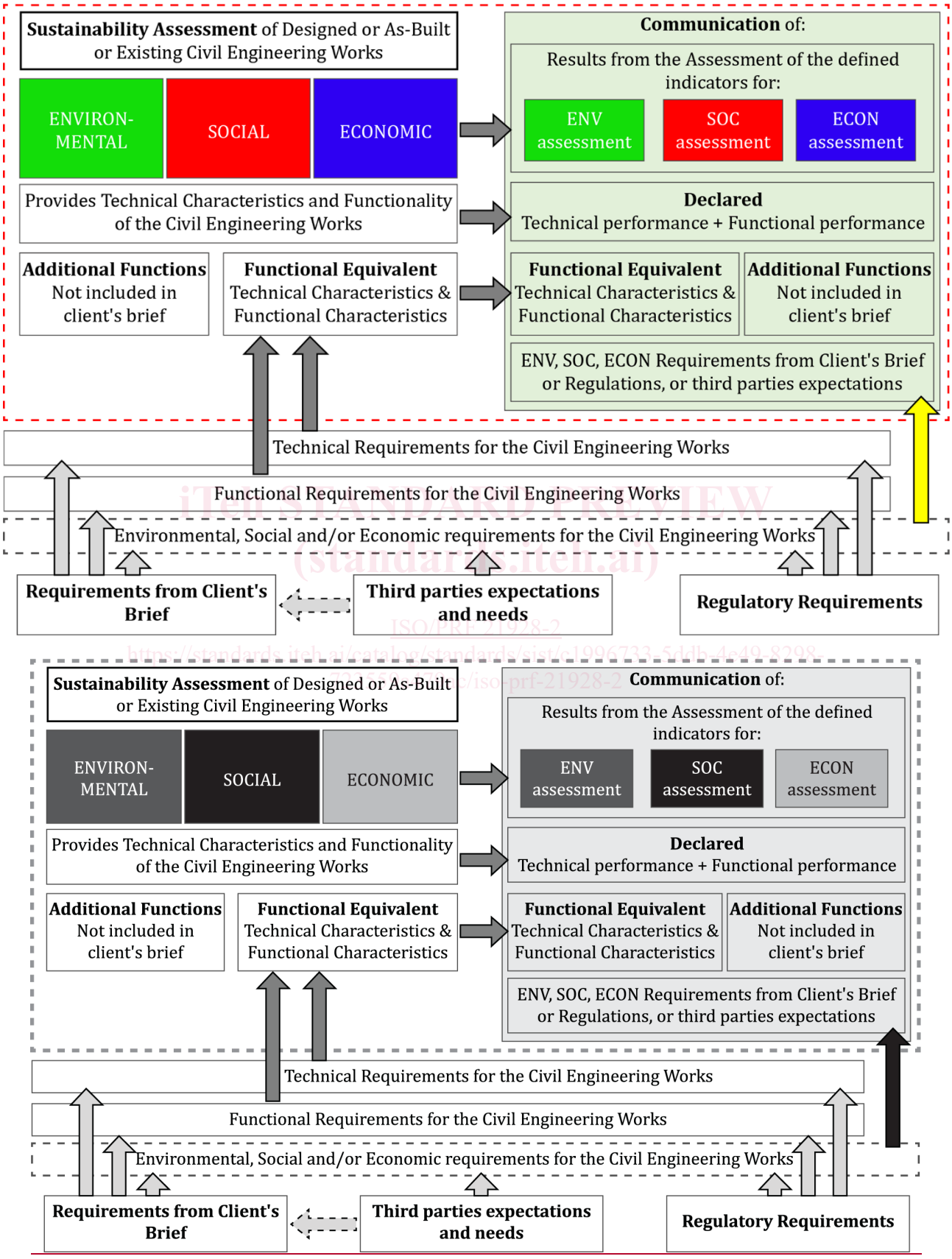
Figure 1 — Suite of related international standards for sustainability in buildings and civil engineering works

Figure 2~~Figure 2~~ illustrates how the assessment of the environmental, economic and social performances fits within the concept of the sustainability assessment of a civil engineering works.



NOTE The outer box with the ~~red~~thick dotted line represents the area within the scope of this document.

Figure 2 — Concept of sustainability assessment of civil engineering works

Indicators related to technical and functional performance are beyond the scope of this document. Technical and functional characteristics are taken into account here by reference to the functional equivalent, which also forms a basis for comparison of the results.

This document supports the development of indicators as a basis for quantification of the contribution of the assessed civil engineering works to sustainable construction and sustainable development.

Third parties' expectations and needs include those from societal, NGOs and local communities.

Environmental, social and/or economic requirements for the civil engineering works (based on the client´s brief, as part of third parties' expectations and needs or imposed by regulation) are taken into account. Thus, they are part of the communication and included in the report . However, they are not assessed.

This document adapts general sustainability principles for civil engineering works and follows the principles set out in ISO 15392 and, where appropriate, is intended to be used in conjunction with, and following the principles set out in, ISO 26000, ISO 14040 and the family of International Standards that includes ISO 14020, ISO 14021, ISO 14024 and ISO 14025. Where deviation occurs, this document goes beyond the requirements of these standards.

Sustainability in buildings and civil engineering works — Sustainability indicators —

Part 2: Framework for the development of indicators for civil engineering works

1 Scope

This document establishes a set of common aspects and impacts for all typologies of civil engineering works, and identifies core sets of environmental, social and economic aspects and impacts for each typology of civil engineering works defined.

The common core set of aspects and impacts described in this document are applicable to all types of civil engineering works. In addition, this document describes specific core sets of aspects and impacts for different typologies of civil engineering works (industrial process infrastructures; linear infrastructures; dams and other fluvial works; maritime works; public spaces; and other civil engineering works not contained in the previous typologies).

Further, the document gives rules for establishing a system of indicators and describes how to use sustainability indicators regarding civil engineering works.

This document does not provide guidelines for the weighting of indicators or the aggregation of assessment results.

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 1996-2:2017, *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of sound pressure levels*

ISO 2631 (all parts), *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration*

~~ISO 6707-1:2017, *Building and civil engineering works — Vocabulary — Part 1: General terms*~~

ISO 14020, *Environmental labels and declarations — General principles*

ISO 14040, *Environmental management — Life cycle assessment — Principles and framework*

~~ISO 14050, *Environmental management — Vocabulary*~~

ISO 15392:2019, *Sustainability in ~~building construction~~buildings and civil engineering works — General principles*

ISO 15686-1:2011, *Buildings and constructed assets — Service life planning — Part 1: General principles and framework*

ISO 15686-2, *Buildings and constructed assets — Service life planning — Part 2: Service life prediction procedures*

ISO 15686-5:2017, *Buildings and constructed assets — Service life planning — Part 5: Life-cycle costing*

ISO 15686-7, *Buildings and constructed assets — Service life planning — Part 7: Performance evaluation for feedback of service life data from practice*

3 Terms and definitions

For the purposes of this document, the following terms and definitions given 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 http://www.electropedia.org/

3.1
airport
area containing an airfield and facilities for handling passengers and cargo

[SOURCE: ISO 6707-1:20172020, 3.1.3.12]

3.2
area of influence
area or combination of areas surrounding a *civil engineering works* (3.6(3.6)) that can be affected with changes to their economic, environmental or social conditions by the civil engineering works' operations throughout its *life cycle* (3.23(3.23))

Note 1 to entry: The area of influence is variable and dependent on the civil engineering works project, its location and its life cycle stage. As an overall approach, the area of influence is usually limited to the civil engineering works itself and its immediate surroundings and neighbourhoods.

3.3
avoided emissions
emissions that are not produced (are avoided) as a result of the implementation of voluntary initiatives or good practices

3.4
built environment
collection of man-made or induced physical objects located in an area or region

Note 1 to entry: When treated as a whole, the built environment typically is taken to include buildings, external works (landscaped areas), *infrastructure* (3.20(3.20)) and other construction works within the area under consideration.

[SOURCE: ISO 21929-1:2011, 3.7, modified — Note 2 to entry has been removed.]

3.5
civil engineering work
work of constructing *civil engineering works* (3.6(3.6))

[SOURCE: ISO 6707-1:20172020, 3.5.1.3]

3.6
civil engineering works
construction works comprising a *structure* (3.40(3.41),), such as a *dam* (3.9(3.9),), bridge, *road* (3.35(3.36),), *rail-transit* (3.30,), runway, utilities, *pipeline* (3.28(3.29),), or *sewerage system* (3.38(3.39),), or the result of operations such as dredging, *earthwork* (3.11,), geotechnical processes, but excluding a building and its associated site works

[SOURCE: ISO 6707-1:20172020, 3.1.1.2]

3.7
civil engineering works system boundary
set of criteria specifying which unit processes are part of the specific analysis of a *civil engineering works* (3.6(3.6).)

[SOURCE: ISO 14044:2006, 3.32 modified — Reference to "a product system" has been replaced by "the specific analysis of a civil engineering works"]"; note 1 to entry has been removed.]

3.8
construction work
activity of forming a *civil engineering works* (3.6(3.6))

[SOURCE: ISO 6707-1:20172020, 3.5.1.1, modified] — The alternative term "construction, US" and note 1 to entry have been removed; "activities" has been changed to "activity"; "construction works" has been changed to "a civil engineering works".]

3.9
dam
barrier constructed to retain water to raise its level, form a reservoir, or reduce or prevent flooding

[SOURCE: ISO 6707-1:20172020, 3.1.2.22]

3.10
dock
partially enclosed or sheltered area of water where vessels may be moored or docked, used for shipping

3.11
earthwork
work of excavating, or the raising or sloping of ground

[SOURCE: ISO 6707-1:2017, 3.5.1.6]2020, 3.5.1.6, modified — The alternative terms "excavation" and "work, US" have been removed.]

3.12
economic aspect
characteristic of *civil engineering works* (3.6(3.6),), part of works, processes or services related to their *life cycle* (3.23(3.23),), that can cause change to economic conditions

[SOURCE: ISO 15392:2019, 3.12, modified — "construction works" has been replaced by "civil engineering works".]

3.13
energy efficiency
measure of energy use against a baseline

EXAMPLE An energy efficient lamp which produces the same amount of light as a conventional lamp but uses up to 75 % less energy to do so.

3.14
environmental aspect
characteristic of *civil engineering works* (3.6(3.6),), part of works, processes or services related to their *life cycle* (3.23(3.23),), that can cause change to environment

[SOURCE: ISO 15392:2019, 3.13, modified — "construction works" has been replaced by "civil engineering works".]

3.15
external costs
costs associated with an asset that are not necessarily reflected in the transaction costs between provider and consumer and that, collectively, are referred to as externalities