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Sustainability in buildings and civil engineering works — Guidelines on the application of the general principles in ISO 15392

Durabilité des bâtiments et ouvrages de génie civil — Lignes directrices sur l'application des principes généraux de l'ISO 15392

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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).

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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 17, *Sustainability in buildings and civil engineering works*.

Introduction

This Technical Specification is intended for use by stakeholders involved during the life cycle of a construction works. More and more decision makers involved in construction projects are establishing goals to improve the sustainability performance of a construction works.

Decision making typically relates to the planning, design, construction, use and operation, and end-of-life processes. The planning and design phases usually include the project inception/initiation, conception of need and feasibility, and initial and detailed design, all of which lead to the actual construction and occupancy of the building.

The objective of providing the guidance included in this Technical Specification is to demonstrate to each actor at each phase of the construction project a way to implement the nine general principles of sustainability in buildings and civil engineering works, as described in ISO 15392.

Although the following topics are currently outside the scope of this Technical Specification, these guidelines can also facilitate the different actors in

— identifying and setting performance targets,

— elaborating relevant practical tools (criteria, indicators, measurement methods) for assessing/measuring the actual performance levels, and

— formalizing a management system based on the general principles of sustainability, which can be monitored, assessed, and improved.

Application of the nine general principles to the life cycle of construction works introduces a multidimensional puzzle leading to a complex framework. Clause 4 presents the different primary elements of the framework and the related facets to be considered regarding each element. Clause 5 introduces the methodological approach for applying sustainability thinking to the development of the construction works and identifies six phases of the decision-making process and 10 sustainability objectives. Clause 6 gives application guidance developed on the basis of these objectives and related issues of concern (see Table 3) and detailed recommendations attached to each issue (see Table 4).

Sustainability in buildings and civil engineering works — Guidelines on the application of the general principles in ISO 15392

1 Scope

This Technical Specification provides guidance for the application of the general principles of sustainability in buildings and civil engineering works elaborated in ISO 15392. It shows the different actors involved with the construction works how to take these principles into account in their decision-making processes in order to increase the contribution of the construction works to sustainability and sustainable development.

This Technical Specification provides a step-by-step approach for

— encouraging the application of the general principles by all stakeholders at each stage of the project and its use, from the decision to build and the initial development of the project brief until the end-of-life of the construction works,

— helping interested parties to consider and/or incorporate sustainability thinking in all phases of the building's or civil engineering works' life cycle, for all relevant issues of concern, by raising key questions in relation to the general principles,

— understanding the outcome (effect) of the application of the general principles, and

— building on acquired experience to develop best practices and engendering a continuous improvement process.

NOTE See Annex A for the list of the nine general principles.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

ISO 14021, *Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)*

ISO 14024, *Environmental labels and declarations — Type I environmental labelling — Principles and procedures*

ISO 14025, *Environmental labels and declarations — Type III environmental declarations — Principles and procedures*

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

ISO 14044, *Environmental management — Life cycle assessment — Requirements and guidelines*

ISO 14050, *Environmental management — Vocabulary*

ISO 15392:2008, *Sustainability in building construction — General principles*

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

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*

ISO 21930, *Sustainability in building construction — Environmental declaration of building products*

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

ISO 26000, *Guidance on social responsibility*

ISO/TR 15686-11[1)], *Buildings and constructed assets — Service life planning — Part 11: Terminology*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions related to sustainability in buildings and civil engineering works in ISO 15392 and ISO/TR 21932 apply. For general terms and definitions related to construction works, service life planning, and environmental management systems and life cycle assessment, the terms and definitions in ISO 6707-1, ISO/TR 15686-11, and ISO 14050 apply.

Where conflicts arise, the terms and definitions within ISO 15392 and ISO/TR 21932 govern.

4 Elements of the framework

Sustainability related to buildings and civil engineering works is a complex issue, and the application of a holistic approach is one of its general principles. When incorporating sustainability thinking into the different processes involved in the development of a construction works, it is important and relevant to keep in mind the elements presented in Table 1, as pieces of a multidimensional puzzle to be assembled. It is important to note that, often, different individual aspects will interrelate with one another.

Table 1 — Primary elements for consideration

Primary elements	Facets to be considered
Primary aspects of sustainability	— environmental protection — economic efficiency — social needs
General principles of sustainability related to construction works (ISO 15392)	— continual improvement — equity — global thinking and local action — holistic approach — involvement of interested parties — long-term consideration — precaution and risk management — responsibility — transparency

1) This Technical Report is under preparation.

Table 1 *(continued)*

Primary elements	Facets to be considered
Components of a vision for construction works to contribute to sustainability and sustainable development	— implementation of an efficient and responsible project management throughout the decision-making process — involvement of all interested parties and be designed to meet affected parties' needs, both individually and collectively — full integration into the relevant local building, town-planning, or environmental-planning schemes and infrastructure — be healthy, comfortable, safe, and accessible for all — be designed or refurbished from a life cycle perspective — minimization of the project's environmental impact over the estimated (or remaining) service life — delivery of economic value over time — delivery of social and cultural value over time for all — be designed (or refurbished) to be user-friendly, cost effective in operation, and with measurable technical and environmental performance over time — be designed (or refurbished) to be adaptable throughout its service life, with an end-of-life strategy
The functions of a building and its site	— support main activities corresponding to users' needs — provide useable and functional indoor and outdoor spaces — provide a healthy indoor environment — provide safety and security — provide for privacy — provide a sense of place
The functions of a civil engineering works	— convey and manage flows (material, water, energy, waste, goods, persons, information, etc.) — store, treat, or convert flows — produce, store, distribute, or manage energy — connect places, functions, or people — produce services for the community — accommodate medium- or large-scale activities — provide safety and security — protect the environment, goods, or people
Main stakeholder groups	— clients — designers: architects, engineers, and related consultants — contractors: builders, constructors, services engineers — suppliers and manufacturers — users — facility managers — community interest groups — regulatory authorities

Table 1 *(continued)*

Primary elements	Facets to be considered
Main types of construction works[a]	— buildings — residential buildings — commercial buildings — public buildings — industrial buildings — etc. — civil engineering works — parks and public spaces — transportation systems — water and sewerage systems — energy generation and distribution systems — waste systems — airports — etc.
Decision-making processes	— strategic planning — project definition — design — construction and handover — operation and maintenance — end-of-life strategy
Geographical scales linked to a project	— construction works and its site — local and extended neighbourhood — city or region
Physical life cycle stages of a construction works (“cradle to grave”)	— production stage (including extraction of raw materials and manufacturing of products) — construction stage — in-use stage (including use, operation, maintenance, repair, replacement, and refurbishment) — end-of-life stage
Combined product and process approach (see Figure 1)	— product-oriented, in terms of performance (technical, functional, environmental, social, economic) of the resulting works — process-oriented, in terms of decision making over the entire life of the works

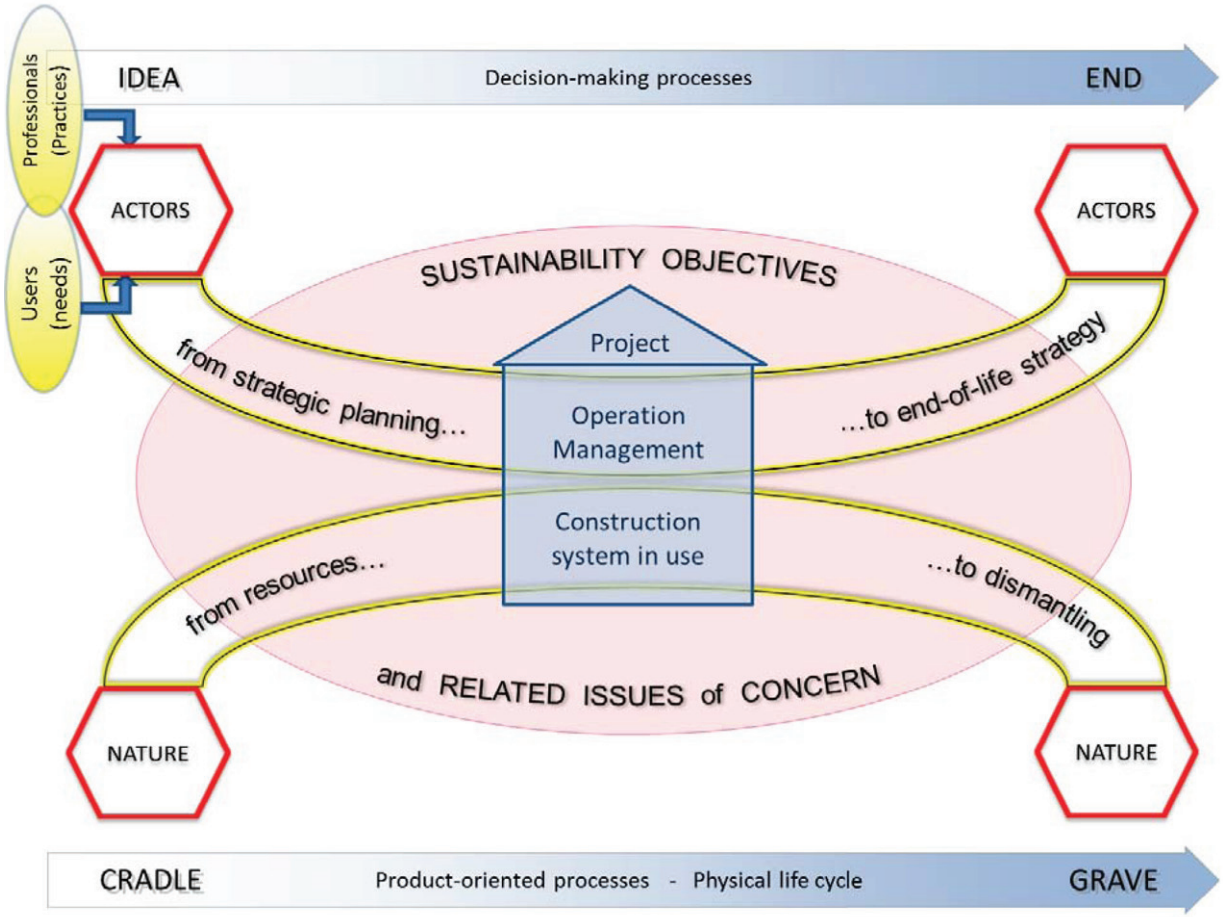

Figure 1 — Diagram of process-oriented and product-oriented life cycles

5 Methodological approach

The starting point of the methodology of applying sustainability thinking to development of construction works is the following sentence, from ISO 15392:

"Sustainable development of buildings and other construction works brings about the required performance and functionality with minimum adverse environmental impact, while encouraging improvements in economic and social (and cultural) aspects at local, regional and global levels. Sustainable development of buildings and other construction works may include consideration of buildings and infrastructure individually and collectively, as well as consideration of single products, functional components, services and processes related to their life cycle".

Six main phases are identified within the decision-making processes that relate to the life cycle of a construction works, from the first expression of a need (idea) until the end-of-life of the works. These are:

— strategic planning (leading to the project definition)
— project definition (leading to the creation of the project/client brief)
— design (conceptual, detailed)
— construction and handover (including commissioning)
— operation and maintenance (including repair, replacement, and refurbishment)
— end-of-life strategy (deconstruction, waste treatment, and disposal)

NOTE 1 National practice can give alternative descriptions and groupings of phases in the life cycle of a construction works. The above presents the terms used in this Technical Specification to identify the key elements that take place in all projects.

NOTE 2 Refurbishment is considered as a sub-project of the use phase including, in itself, strategic planning, project definition, design and construction, and also the end-of-life of some elements such as exterior claddings, windows, partitions, and interior finishes.

From a process or management point of view, the main phases of the decision-making process related to a construction project, together with the stakeholders and their actions/decisions at each phase, are the core elements for this Technical Specification (see Table 2).

From a point of view of sustainability objectives, the thematic issues of concern provide the basis for operational guidance and the technical and management recommendations (see Tables 3 and 4).

In simple terms, each phase will

— raise questions that need to be addressed,

— implicate the various stakeholders or actors needing to answer these questions, and

— end with an optimal result or deliverable.

This is made more explicit in Table 2.

Table 2 — The six phases of the decision-making process

Decision-making process	Questions raised	Main stakeholders (or actors)	Result/deliverables
Strategic planning	— What is the demand? — What are the needs? — What are the sustainability objectives? — What are the opportunities and constraints of the site?	Clients, users, community interest groups	— Preliminary objectives — Decision to proceed or not
Project definition	— What are the technical and functional requirements? — What are the environmental, economic, and social performance requirements?	Clients, users, community interest groups	— Project detailed objectives — Creation of the project/client brief[a]
Design	How is the demand expressed into a project, first schematically and then in detail?	Designers, engineers, clients, users, regulatory authorities, community interest groups	A sustainable construction project, with detailed drawings and specifications
Construction and handover	How is the design realized and the works handed over to users?	Contractors, suppliers, manufacturers, clients, users	A sustainable construction process, a sustainable works/asset, a user guide, specifications for use
Operation and maintenance	How to operate and maintain the built environment in an effective, sustainable way?	Clients, users, facility managers, suppliers, community interest groups	A sustainable service life, including continuous improvement
End-of-life strategy	Once full obsolescence is reached, how to deal with the end-of-life, without creating damage to the environment or the community?	Clients, suppliers, contractors, community interest groups	A sustainable exit strategy and its realization, a clean site

[a] The resulting brief is expected to balance the consideration of the technical, functional, environmental, economic, and social aspects and to prioritize the related performance requirements.

The guidance in Clause 6 demonstrates to each actor, at each phase of the construction project, a way to implement the nine general principles. Although they might be seen as rather conceptual, they can be used, from an intellectual perspective, as a framework against which decisions can be checked. The most practical way to implement them is to translate them into sustainability objectives and related issues of concern, with both a product-oriented and a process-oriented approach.

Sustainability objectives and issues of concern are the items or requirements that need to be raised and taken into consideration at different critical points throughout the project life cycle, starting with the choice of the site and the elaboration of the brief, which is a critical document. These items/requirements need practical solutions to help ensure the maximum contribution to sustainability and sustainable development from the construction works. All the actors involved in the process should have these items/requirements in mind, while knowing that solutions shall be given, and be conscious that each of the actors has a role and a responsibility in enabling those solutions to be progressively elaborated throughout the project's life cycle.

The sustainability objectives identified in this Technical Specification, corresponding to the "vision" presented in Table 1, are as follows:

a) efficient and responsible management throughout the process;

b) involvement of interested parties and consideration of their needs;

c) integration into the relevant planning schemes and policies (including sustainability planning) related to local building/town-planning and infrastructure;

d) functionality, health, comfort, safety, and accessibility;

e) consideration of a life cycle perspective;

f) limitation of adverse environmental impacts;

g) provision of economic value over time;

h) provision of social and cultural value over time and for all;

i) performance management during operation;

j) adaptability and end-of-life strategy.

6 Application guidance

In this Clause, the sustainability objectives are detailed in issues of concern, each being expressed as a short list of statements, actions, or recommendations. These are intended to make the objectives and issues more evident for the various stakeholders' consideration.

Table 3 presents the list of sustainability objectives and related issues of concern, and indicates whether they are linked to

— the three primary aspects of sustainability,

— the nine general principles of sustainability related to construction works,

— either a building or civil engineering works, or both, and

— either a product- or process-oriented approach, or both.

It is particularly important that all the issues presented in Table 3 are considered from the initiation of the project, during the project definition, and the elaboration of the brief. A brief that appropriately integrates these issues (detailing the three primary aspects of sustainability) is likely to result in a project that contributes positively to sustainable development.

NOTE Buildings and other types of construction works are designed to meet numerous requirements, expressed and established in national and international standards or regulations. None of these requirements is replaced or changed by this Technical Specification. Compliance with legislation and regulations represent prerequisites for any project and are not addressed within the tables.

Table 3 — List of sustainability objectives and issues versus primary aspects, general principles of sustainability, works, and approach

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long-term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
A — Efficient and responsible management throughout the process **Purpose:** Early identification of needs and roles of interested parties, clear project organization and planning at each phase, shared decision making, traceability, with good anticipation of risks, problems, and conflicts **Outcome:** Elaboration of a sustainable and concerted brief, then an optimized project meeting the brief requirements, and a construction works reaching and maintaining the expected performances; satisfaction of the client, the users, and the local community, while applying responsible patterns of production and consumption	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
A1 — Establishment of the sustainability policy of the client or main decision-maker and communication of the vision	x	x	x			x					x	x	x	x		x
A2 — Availability of resources (e.g. financial, technical, human, etc.)		x	x						x		x		x	x		x
A3 — Implementation of an integrated multidisciplinary approach throughout the process	x	x	x				x				x	x	x	x		x
A4 — Adoption of an iterative process and validation of the choices at each key stage	x	x	x	x			x	x			x	x	x	x		x
A5 — Management of risks	x	x	x			x	x		x	x	x		x	x		x
A6 — Responsible sourcing	x		x			x					x	x	x	x		x
A7 — Formalization of contracts and responsibilities between parties	x	x	x	x			x	x		x	x	x	x	x		x
A8 — Achievement of the expected performance	x	x	x	x			x			x	x		x	x	x	x

Table 3 — *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long-term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
A9 — Respect of human values			x		x			x			x	x	x	x		x
A10 — Establishment of transparent decision-making and communication processes			x					x			x	x	x	x		x
A11 — Learning from experience	x	x	x	x				x				x	x	x		x
A12 — Periodic review of the management system	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
A13 — Innovation	x	x	x	x	x	x	x		x	x			x	x	x	x
A14 — Impacts on the local environment	x	x	x			x		x	x		x		x	x	x	x
B — Involvement of interested parties and consideration of their needs **Purpose:** Early identification of the different parties' roles, needs, desires, values, and requirements and of conflicts that might arise **Outcomes:** The opportunity for known interested parties to engage in the decision-making process from the outset of the project and maintain communication and dialogue Resolution of conflicts and creation of a sustainable brief Satisfaction of users and other interested parties with the brief, the design, and the use	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
B1 — Identification, characterization, and involvement of the future end users and their needs		x	x		x			x	x			x	x	x		x
B2 — Identification and involvement of other interested parties	x	x	x		x	x		x	x			x	x	x		x
B3 – Management and resolution of contradictions or conflicts among the opinions of the interested parties			x		x	x		x	x	x	x		x	x		x

Table 3 — *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
B4 — Satisfaction of users and other affected parties			x	x	x		x	x	x	x			x	x		x
C — Integration into the relevant planning schemes and policies (including sustainability planning) related to local building/ town-planning and infrastructure **Purpose:** To ensure sense of place and synergies within the local environment **Outcome:** A 'good fit' (contributing to and respecting) within the local context	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C1 — Survey of the local environment	x	x	x				x			x		x	x	x	x	x
C2 — Contribution to local appeal and the quality of life	x	x	x	x		x			x	x			x	x	x	
C3 — Creation of synergies within the existing context	x	x	x			x	x		x	x	x		x	x	x	x
C4 — Optimization of the degree of access to public and personal transport, other services, and amenities (including schools, shops, green and open spaces, etc.)	x	x	x		x	x		x					x	x	x	x

Table 3 *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
D — Functionality, health, comfort, safety, and accessibility **Purpose:** To specify performance requirements during the service life of buildings and meet identified requirements on functionality, health, comfort, safety, and accessibility; to establish, at the key stages of the process, rational criteria for indoor air quality, thermal comfort, acoustical comfort, visual comfort, HVAC system controls, and accessibility **Outcome:** Provide indoor and outdoor spaces that meet the needs of the users and other affected parties in terms of well-being, productivity, and serviceability, without compromising the respect of other sustainability issues	x	x	x		x	x	x	x	x	x			x	x	x	
D1 — Description of the intended use (and related requirements) of the construction works and end users' needs							x					x	x	x	x	x
D2 — Assessment of serviceability		x	x		x		x						x		x	
D3 — Functional flexibility	x	x	x	x		x	x		x				x	x	x	
D4 — Provision of good indoor air quality	x	x	x			x			x	x			x		x	

Table 3 — *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
D5 — Provision of good visual comfort		x	x				x	x	x				x	x	x	
D6 — Provision of good acoustic comfort		x	x				x	x					x	x	x	
D7 — Provision of good thermal comfort		x	x					x					x		x	
D8 — Provision of a safe and resistant construction works during exceptional events		x	x			x	x		x	x	x		x	x	x	
D9 — Provision of accessibility for all		x	x		x		x		x				x	x	x	
E — Consideration of a life cycle perspective **Purpose:** Bring into practice the life cycle thinking approach in the key stages of the project/ process **Outcome:** Decisions integrating information from life cycle thinking and analysis, dealing with environmental, economic, and social issues	x	x	x			x	x	x	x	x	x	x	x	x	x	x
E1 — Provision of information to successive actors to ensure they are aware of the initial principles, objectives, and technical and architectural choices that are specific to the construction works, and the implications of these for its operation and its disposal at the end-of-life	x	x	x	x			x		x		x	x	x	x		x
E2 — During brief and design phases, establishment of an expected service life of the building, including maintenance, replacement, and end-of-life plans	x	x					x		x	x	x	x	x	x	x	
E3 — When making a decision, consideration of its implications for all subsequent stages of the life cycle	x	x				x	x	x	x	x	x	x	x	x	x	x

Table 3 — *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
F — Limitation of adverse environmental impacts **Purpose:** To understand the environmental implications of proposed design and construction solutions, making any adverse impacts as low as is reasonably practical and maximizing environmental benefits **Outcome:** Optimization of the design and construction solution in relation to its local, regional, and global environmental impacts, in both the short and long term	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
F1 — Use of resources (materials)	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
F2 — Energy resources consumption	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
F3 — Water resources consumption in use	x	x		x	x	x	x	x	x	x	x	x	x	x	x	
F4 — Efficiency of land use	x	x	x	x	x		x	x	x		x	x	x	x	x	
F5 — Reduction of GHG emissions	x		x	x	x	x	x	x	x	x	x	x	x	x	x	
F6 — Reduction of other airborne emissions that have large-scale effects	x		x	x	x	x	x	x	x	x	x	x	x	x	x	
F7 — Waste reduction and management (construction and operation)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
F8 — Protection and/or enhancement of biodiversity	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
F9 — Reduction of construction site pollution	x	x	x	x	x		x	x		x	x	x	x	x	x	
F10 — Management of other environmental risks	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 3 — *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
G — Provision of economic value over time **Purpose:** To enable short-term and long-term cost optimization; to avoid sub-optimization and shift of liability to other parties or beyond the system boundary To enable integration of costs in holistic assessments at different relevant system levels To allow and enable comparisons for decision making at the scope of the current decision and its consequences within the chosen boundaries To allow analysis of validity of results and preferences in application of different scenarios **Outcome:** Identification and transparent documentation of quantified costs for the subject under study, over a defined period of analysis and defined scope		x		x			x		x	x	x	x	x	x	x	
G1 — Total cost of ownership		x			x				x			x	x	x	x	
G2 — Economic viability		x							x	x			x	x	x	
G3 — Life cycle cost optimization		x			x							x	x	x	x	
G4 — Consideration of externalities	x	x	x			x	x			x	x		x	x	x	
G5 — Consideration of impacts of the construction works and related activities on the local economy		x	x			x					x		x	x	x	
G6 — Value over time		x		x					x	x			x	x	x	

Table 3 — *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
H — Provision of social and cultural value over time and for all **Purpose:** Ensure provision of and/or access to social and cultural services; facilitate social mix and good social climate, at the building scale and as a contribution to the local context **Outcome:** A construction works that contributes to the social and cultural attractiveness of the neighbourhood, leading to users' and neighbours' satisfaction; a construction works that contributes to social cohesion, equity, and progress		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H1 — Quality of social life			x	x	x	x	x		x		x		x	x	x	x
H2 — Quality of cultural life			x		x			x	x				x	x	x	x
H3 — Security		x	x		x		x	x		x	x	x	x	x	x	x
H4 — Contribution to social equity and improvement in the social climate		x	x	x	x	x				x	x	x	x	x	x	x
H5 — Social and functional diversity			x		x		x	x					x	x	x	
H6 — Socio-economic conditions		x	x		x	x	x		x		x		x	x	x	x

Table 3 *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
I — Performance management during operation **Purpose:** To satisfy the required functions of a construction works through appropriate operation and maintenance over its use phase, by means of performance indicators **Outcome:** Provision of functions at the desired quality all through use phase of the construction works	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
I1 — Ability to operate and maintain	x	x		x					x		x		x	x		x
I2 — Performance monitoring over time	x	x		x					x		x	x	x	x	x	x
I3 — Replacement and refurbishment strategy	x	x	x				x		x				x	x	x	x
I4 — Users' feedback and lessons from experience			x	x	x			x	x	x	x	x	x	x		x
I5 — User behaviour	x	x	x	x	x			x			x		x			x

Table 3 *(continued)*

Sustainability objectives and related issues of concern	Aspects			General principles of sustainability									Works		Approach	
	Environmental	Economic	Social	Continual improvement	Equity	Global thinking and local action	Holistic approach	Involvement of interested parties	Long term consideration	Precaution and risk management	Responsibility	Transparency	Building	Civil engineering	Product-oriented	Process-oriented
J — Adaptability and end-of-life strategy **Purpose:** Incorporation of design and construction features that make it easy for a construction works to be reused or disassembled and products and assemblies to be recovered or for the construction works to be easily modified for change of use or to adapt to climate change **Outcome:** Reduction in the environmental footprint by reducing waste and/or avoiding use of new resources through recovery of materials for reuse, recycling, or energy recovery; improving construction works longevity; and reduction of energy consumption by intelligent design	x	x	x	x			x		x	x			x	x	x	x
J1 — Adaptability for different uses		x	x	x			x		x	x			x		x	x
J2 — Ease of disassembly	x	x		x						x			x	x	x	x
J3 — Recovery of materials for reuse, recycling, and energy recovery potential	x	x					x		x				x	x	x	x
J4 — Adaptability in response to climate change	x	x		x			x		x				x	x	x	x

Table 4 gives detail to each issue of concern together with guidance and recommendations. The issues are also marked as to their relevance to four categories of questions.

— Who is involved in dealing with or identifying a solution to that issue?

— In which context should the issue be considered?

— To which phase of the project/process does the issue relate?

— To which stage of the life cycle of the construction works does the issue refer?

Table 4 — Detailed list of issues of concern, guidance, and recommendations

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-process phase						Life cycle stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
A — Efficient and responsible management throughout the process																	
A1 — Establishment of the sustainability policy of the client or main decision-maker and communication of the vision — Define the key elements of the sustainability policy for the project. — Communicate this policy to the stakeholders.	X				X	X	X	X									
A2 — Availability of resources (e.g. financial, technical, human, etc.) — Ensure the resources available for the project correspond to the ambitions of the project. — Make sure the resources available for the operation and maintenance allow an optimal use of the works.	X				X			X	X			X				X	
A3 — Implementation of an integrated multidisciplinary approach throughout the process — Identify the necessary professional skills needed. — Facilitate integrated working.	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
A4 — Adoption of an iterative process and validation of the choices made at each key stage — Undertake regular project reviews.	X			X	X				X	X	X			X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/engineer	Contractor/builder	Operator	Construction works	Neighbourhood	City/region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
A5 — Management of risks — Anticipate the administrative, technical, and human issues, through early planning in sufficient detail. — Identify and assess the financial, social, environmental, and technical risks, considering short-, medium-, and long-term issues. — Determine acceptability and act accordingly. — Undertake a regular review.	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X
A6 — Responsible sourcing — Establish a responsible sourcing strategy for products and services.	X	X	X	X	X				X	X	X	X		X	X	X	
A7 — Formalization of contracts and responsibilities between parties — Establish contracts suitable for the project and its specificities. — Make sure that interfaces between actors are well organized and formalized.	X	X	X	X	X			X	X	X	X	X	X		X	X	
A8 — Achievement of the expected performance — Set targets for performance. — Carry out a performance assessment and review if any significant change in design or targets occurs. — When the targets are not met, determine acceptability and act accordingly. — Implement best practice certification schemes, labels, and relevant standards.	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
A9 — Respect of human values — Identify the relevance and significance of issues related to human values and address them appropriately (e.g. responsible behaviour, labour rights, consumer issues, equity, ethical behaviour, according to the principles of ISO 26000).	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X
A10 — Establishment of transparent decision-making and communication processes — Ensure traceability and good quality documentation (e.g. relevant, complete, adapted to the user/reader, up-to-date) and its appropriate dissemination. — Adopt factual approach to decision-making, based on best available data and information and consequence analysis.	X	X	X	X	X	X		X	X	X	X	X	X				
A11 — Learning from experience — Benefit from past experiences or projects. — Capitalize present experience for continuous improvement.	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X
A12 — Periodic review of the management system — Check effectiveness of existing management system and consider improvement as necessary.	X	X	X	X	X			X	X	X	X	X	X				
A13 — Innovation — Investigate whether innovative solutions/ approaches have the potential to provide a more sustainable solution (technical, organizational, financial, etc.).	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
A14 — Impacts on the local environment — Develop a work schedule and traffic plans. — Limit the impacts on the local environment (e.g. due to noise, dust, light pollution, glare, localized wind effects).	X	X	X	X	X	X			X	X	X	X	X		X	X	X
B — Involvement of interested parties and consideration of their needs																	
B1 — Identification, characterization, and involvement of the future end users and their needs — Identify the demographic features and other characteristics of the end users. — Identify the end users' needs, desires, values, and requirements. — Decide when and how the end users should be involved.	X	X		X	X			X	X	X		X			X	X	
B2 — Identification and involvement of other interested parties — Identify other key interested parties [e.g. the neighbours, local authorities, local associations, professionals (service providers and operators)]. — Decide when and how the other interested parties should be involved. — Establish their level, importance, influence, and their role.	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	
B3 — Management and resolution of contradictions or conflicts among the opinions of the interested parties — Take measures to ensure early identification of contradictions or conflicts and their resolution.	X	X	X	X	X	X		X	X	X	X	X	X				

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
B4 — Satisfaction of users and other affected parties — Decide how and when the satisfaction of the users will be determined and assessed. — Decide how and when the satisfaction of the other interested parties will be determined and assessed. — Take into account their concerns in order to improve satisfaction and draw lessons for future projects.	X	X	X	X	X	X	X	X	X	X	X	X	X				
C — Integration into the relevant planning schemes and policies (including sustainability planning) related to local building/ town-planning and infrastructure																	
C1 — Survey of the local environment — Conduct a multi-criteria survey/analysis of the local environment prior to setting objectives for the project. — Determine the needs, opportunities, constraints, and limitations for the works in context (e.g. national, regional, and/or local planning policies and regulations, etc.). — Implement decisions or solutions based on the findings of the survey.	X	X			X	X	X	X	X	X				X	X		

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/engineer	Contractor/builder	Operator	Construction works	Neighbourhood	City/region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
C2 — Contribution to local appeal and the quality of life — Identify the factors (shape, outdoor spaces, landscape, etc.) to be considered when setting the works in the local context. — Assess the project's contribution to the improvement of the neighbourhood/district image, the local economy, and the quality of life.	X	X		X		X	X	X	X	X		X		X		X	
C3 — Creation of synergies within the existing context — Identify the factors (links, space and functions, continuity, contribution) that fit within and enhance the local environment. — Ensure coherence between the site development and the policy of the local community regarding sustainable development planning, including environment protection (energy, sewage, waste, rainwater, water resource, services, transport, risks, etc.).	X	X	X	X		X	X	X	X	X		X		X	X	X	
C4 — Optimization of the degree of access to public and personal transport, other services, and amenities (including schools, shops, green and open spaces, etc.) — Analyse the presence, quality, and proximity of local transport modes, other services, and amenities. — Initiate dialogue with the local community representatives in order to ascertain what opportunities or mechanisms can be developed to improve the situation.	X	X		X		X	X	X	X	X		X				X	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
D — Functionality, health, comfort, safety, and accessibility																	
D1 — Description of the intended use (and related requirements) of the construction works and end users needs — Describe the primary functions of the works (e.g. school, offices, retail, residential, etc.). — Define the functional performance required for each space and user group: — spatial arrangement, connectivity, and geometry (area, access, etc.); — operating conditions; — maintainability; — specific requirements. — Define the profiles of performance required to achieve the expected levels of functionality, health, comfort, safety, and accessibility.	X				X	X		X	X			X			X	X	
D2 — Assessment of serviceability — Assess the levels of performance attained for each space and user group. — Determine whether the level of serviceability is adequate to meet the profiles of performance required, and act accordingly.	X	X		X	X	X				X	X	X			X	X	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/engineer	Contractor/builder	Operator	Construction works	Neighbourhood	City/region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
D3 — Functional flexibility — Ensure the works' ability to accommodate: — individual user requirements; — change of user requirements; — technical changes; — change of use of some areas. NOTE See also adaptability issues in section J.	X	X			X			X	X	X					X	X	
D4 — Provision of good indoor air quality — Identify and manage health risks (local radon, contaminated soil, asbestos, electromagnetic fields, CO intoxication, etc.). — Take into account the health risks for users (water, air, soil, fumes, odours, noise, electromagnetic, etc.) in the choices of design and construction principles. — Consider the potential for materials, products, and systems used to become sources of health risk in the future. — Identify and avoid conditions that could lead to excess moisture and/or mould. — Identify and avoid olfactive nuisances, from indoor and outdoor sources. — Pay attention that functional flexibility will not compromise the indoor air quality (e.g. regarding the ventilation system).		X	X	X	X	X			X	X	X	X		X	X	X	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
D5 — Provision of good visual comfort — Provide an indoor visual environment corresponding to the intended activities in the building, including architectural and engineering aspects of daylighting and artificial lighting for users' satisfaction and well-being. — Optimize size and orientation of windows; avoid glare and reflections. — Maximize pleasant views on outdoor spaces.		X		X	X	X			X	X		X			X	X	
D6 — Provision of good acoustic comfort — Provide indoor acoustic conditions adapted to the intended activities in the building, including architectural and engineering aspects of acoustics (sound attenuation, noise reduction) for users' satisfaction and well-being. — Consider outdoor sources of noise. — Consider indoor sources of noise, including plumbing, mechanical services, and process equipment. — Consider and reduce noise during the construction or refurbishment phase (for the workers, the users occupying the building, the neighbours).		X	X	X	X	X			X	X	X				X	X	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
D7 — Provision of good thermal comfort — Provide indoor thermal conditions according to the scenarios of use, in all seasons. — Consider the main parameters influencing thermal comfort, as air temperature, radiant temperature, air humidity, air velocity, user's characteristics and activity, taking account of outdoor climate and activity devices. — Use simulation tools in order to anticipate and improve thermal conditions of the premises during design.		X	X	X	X		X		X	X	X	X			X	X	
D8 — Provision of a safe and resistant construction works during exceptional events — Identify exceptional events that might occur. — Minimize the likelihood of unacceptable risks of injury or damage. — Consider importance of functional continuity of activities supported by the building or infrastructure. — Establish a minimum level of functional performance, during and after the event, typically based on national or local codes/regulations or required by the client's brief.		X	X		X		X		X	X	X	X			X	X	
D9 — Provision of accessibility for all — Provide spaces able to be entered and used with ease by all users (with different kinds of physical or cognitive abilities), including indoor and outdoor spaces of buildings, transport infrastructure, public spaces, etc.		X			X		X		X	X					X	X	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
E — Consideration of a life cycle perspective																	
E1 — Provision of information to successive actors to ensure they are aware of the initial principles, objectives, and technical and architectural choices that are specific to the construction works, and the implications of these for its operation and its disposal at the end-of-life — Create records for the operating actors on critical features of the works that relate to sustainability issues.	X	X	X	X	X					X	X	X	X	X	X	X	X
E2 — During brief and design phases, establishment of an expected service life of the building, including maintenance, replacement, and end-of-life plans — Determine the expected service life of the construction works and of its components. — Define essential maintenance and replacement plans accordingly.	X	X	X		X				X	X	X			X	X	X	
E3 — When making a decision, consideration of its implications for all subsequent stages of the life cycle — When a decision is to be made, have a systematic review of the potential environmental, social, and economic effects of that decision during the life cycle of the project, e.g. through the use of LCA, LCC, and/or other assessment tools. Refer to ISO 14040, ISO 14044, and ISO 15686-5.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/engineer	Contractor/builder	Operator	Construction works	Neighbourhood	City/region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
F — Limitation of adverse environmental impacts																	
F1 — Use of resources (materials) — Consider the environmental benefits of reusing existing major elements/structures/frames/foundations. — Establish a basis for choices of materials and set environmental targets, e.g. embodied energy, renewable materials. — Consider potential for use of recovered/recycled materials or elements. For environmental labels and declarations, especially for environmental product declarations, refer to the relevant International Standards: ISO 14020, ISO 14021, ISO 14024, ISO 14025, ISO 21930, and ISO 21931-1.	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X

Table 4 *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
F2 — Energy resources consumption — Establish basis for improving energy efficiency and set targets across all phases of the project. — Consider options available to minimize energy use: — review possible passive design strategies to optimize thermal performance, insulation, airtightness, and ventilation; — use of natural ventilation and energy efficiency options relating to heating/cooling, hot water systems, lighting systems and daylighting, and internal transport (lifts, escalators, etc.). — Consider options for building systems controls: automation and user interfaces, including the need for user guidance and training. — Develop a programme for commissioning of building systems and system controls and taking account of seasonal variations. — Consider options available to optimize use of renewable energy sources and opportunities for exporting excess energy generated.	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/engineer	Contractor/builder	Operator	Construction works	Neighbourhood	City/region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
F3 — Water resources consumption in use — Establish basis for improving water efficiency and set targets across all phases of the project. — Consider options available to minimize water consumption and possible design strategies to optimize performance (e.g. low/zero water use, sanitary fittings, rainwater/grey water recycling/use). — In landscaping, ensure the vegetation choices are compatible with current and anticipated rainfall patterns. — Optimize water management and irrigation systems to control water consumption.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
F4 — Efficiency of land use Take measures to ensure that the project: — uses previously developed or contaminated land or land of low ecological value with a long-term ecology management/improvement plan; — avoids the use of previously undisturbed land and minimizes impacts on areas of high ecological value/outstanding natural beauty; — optimizes the use of space and land: — development density and the relationship with surroundings: fit to local context and needs; — efficient use of internal and external spaces, consider: flexibility and area of internal spaces are appropriate for intended use; — adaptability over time: consider potential/ease of adaptation for future use/change of use.	X	X			X	X	X	X	X	X				X			X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
F5 — Reduction of GHG emissions — Determine action to be taken to reduce likelihood of emissions of greenhouse gases other than through energy consumption (see F1), e.g. prevention of emissions of materials such as refrigerants and other compounds that have high global warming potential (GWP).	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X
F6 — Reduction of other airborne emissions that have large-scale effects — Supply heat and/or coolth from a system that minimizes NOx emissions, and therefore reduces pollution of the local environment.	X	X		X	X	X		X	X	X		X		X		X	X
F7 — Waste reduction and management (construction and operation) — Promote resource efficiency through effective management and reduction of waste. — Consider how design and fabrication can optimize use of materials (dimensions, off-site pre-assembly) to avoid unnecessary waste of materials. — Establish a waste management plan for the construction works for each key phase of its life cycle (construction, use, demolition/ disposal). — Consider options available for reduction/recycling of waste and avoidance of long distance transportation of waste and waste going to landfill. — Set targets for waste at each stage of the process.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4 — (continued)

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/engineer	Contractor/builder	Operator	Construction works	Neighbourhood	City/region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
F8 — Protection and/or enhancement of biodiversity — Establish measures that will contribute to reducing adverse effects of land use through actions to maintain and enhance the ecological value of the site as an integral part of development. — Develop a biodiversity action plan which includes: — design features to encourage wildlife and habitat development; — protection of local habitat during construction; — landscape planning and management to protect/enhance future biodiversity.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
F9 — Reduction of construction site pollution — Set requirements for plant and equipment fuel type/efficiency and maintenance. — Plan necessary steps to minimize surface water run-off and prevent contamination of the local environment.	X	X	X		X	X	X	X	X	X	X		X	X	X		X
F10 — Management of other environmental risks — Establish strategies for minimizing other environmental impacts as appropriate for the local conditions and building/construction works typology.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
G — Provision of economic value over time																	
G1 — Total cost of ownership Estimate/calculate total cost of ownership including sub-categories: — non-construction cost; — construction cost; — operation cost; — maintenance (and replacement) cost; — end-of-life cost. Establish an LCC model applying the ISO 15686-5 methodology, define adaptable methodology options, and document transparently: — scope of the analysed system; — included cost categories; — period of analysis; — scenarios for the use stage; — scenarios for maintenance and replacement; — scenarios for development of performance over time; — scenarios for price increase rates and inflation. NOTE 1 Refer to ISO 15686-5.	X	X			X	X			X	X	X	X	X	X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
— Concerning system level, define a scope for cost analysis, in accordance to the decision at hand. Embed that analysis in a model covering the overall construction works and the full life cycle to avoid sub-optimization, or to enable analysis of conflict of interests. — Concerning stakeholder interests, establish an LCC model that allows to optimize the concerns of specific parties, but that additionally allows to conduct LCC quantifications for other interests as well. NOTE 2 "Total cost of ownership" implies that only the costs occurring to the building owner are considered. — Regarding dependence on methodology choices, identify reasonable scenarios, and also investigate diverging scenarios representing more benign or more risky boundary conditions. Display results for the chosen scenarios combined with results for other scenario combinations in order to enable the analysis of result dependency on certain scenario combinations. — Enable analysis of the LCC calculation. — Establish calculation structure and result presentation that reflects later interpretation needs. Especially allow analysis of different cost categories, life cycle stages, main construction elements, etc. A well-structured presentation of the results can serve as a basis for LCC optimization as well as for tracing errors and identifying trends.																

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
G2 — Economic viability																	
Gather information related to other economic aspects than life cycle costs:																	
— income from use;																	
— available budget for operation and maintenance;																	
— risks associated with market position of the asset, potential vacancy/redundancy, development of income;																	
— development of the asset value over time;																	
— development of performance over time;	X	X			X	X		X	X	X		X	X	X		X	X
— efforts required to adapt to user or use changes;																	
— efforts required to adapt to changing requirements.																	
Set up balance of costs and income for the asset:																	
— identify development of asset economy over time;																	
— identify critical points in time;																	
— identify critical events (e.g. replacements).																	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
	Client	Designer/ engineer	Contractor/ builder	Operator	Construction works	Neighbourhood	City/ region	Strategic planning	Project definition	Design	Construction and handover	Operation and maintenance	End-of-life strategy	Production	Construction	In-use	End-of-life
G3 — Life cycle cost optimization Life cycle costs display the costs accumulated over the building life cycle. For details, see ISO 15686-5. Consider to include costs of: — land, infrastructure, and clearing; — planning, fees, and taxes; — construction; — operation and maintenance; — replacement of components; — end-of-life scenarios (refurbishment, redevelopment, and deconstruction). Optimization can also involve a comparative analysis of options. As not only the total sum of costs accumulated over the life cycle can be relevant, consider the display of annual costs, costs per building elements or technical components, costs not distributable to tenants, accumulated life cycle costs, net present value, and annuity. Calculation of return on investment and payback periods involves initial cost, operation costs, and revenue. The variation within these costs and revenues needs to be evaluated when considering options for the purpose of optimization. When conducting partial analyses of, e.g. technical components, it shall be ensured that only differences attributable to the compared options are included.	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
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— Identify performance targets and designate to what extent they are negotiable. — When carrying cost optimization (or value engineering) ensure that identified performance requirements, goals for value-over-time or sustainability targets are not jeopardized by the cost optimization. — Embed such comparisons also in overall building perspective to indicate absolute relevance. — Ensure that potential influence on income and value over time is included in evaluation of options. — Identify potential fields for cost optimization based on overall cost distribution, opportunities, and constraints. — Conduct life cycle cost optimization at significant decision points throughout the decision-making process. — Maintain former calculations as reference in order to display the direction of development. — Ensure optimization is not entirely dependent on some external parameters, especially if their development over time is unsure and beyond the control of involved stakeholders. — Apply different scenarios or parameters to comparative LCC calculation of options, to ensure optimization is reliable and resistant to smaller changes in the business environment.																	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
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— Introduce priorities for ranking of options, such as return on investment, payback period, relevance with respect to overall cost, dependency on external factors, robustness to development scenarios, impact on other concerns, goals, or priorities. — Resolve conflicts of interests.																	
G4 — Consideration of externalities — Identify parameters of concern or aspects external to the project and the actors involved. — Evaluate costs versus benefits of these externalities in monetary terms.	X	X			X	X	X	X	X	X	X	X	X		X	X	X
G5 — Consideration of impacts of the construction works and related activities on the local economy — Identify economic interrelation with other economic activity in the area and the region. — Identify impacts on other businesses and other activities related to the project. — Encourage positive impacts on the local economy.	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X
G6 — Value over time — Consider maintainability, flexibility, and adaptability to enable economic performance to be maintained in changing market conditions or in response to changes in user requirements. — Minimize risk of obsolescence occurring.	X	X	X	X	X				X	X		X		X	X	X	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
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H — Provision of social and cultural value over time and for all																	
H1 — Quality of social life — Identify the existence of green spaces, leisure and sporting amenities, and local associations in the neighbourhood. — Provide users with reserved spaces (indoor and outdoor) for rest and relaxation, and enable all the users to enjoy them, and manage the proper use of these spaces. — Provide spaces to meet neighbours or other people and develop conditions for social interaction. — Improve living and working conditions of inhabitants and/or users, according to their needs, e.g. for elderly. — Ensure better connectivity between dwellings and working places. — Look for opportunities to: — provide benefits for the neighbourhood, in terms of quality of life, new services, or other advantages; — contribute to meeting identified local/ regional social needs.	X	X	X	X	X	X		X	X	X	X	X			X	X	

Table 4 — *(continued)*

<table>
<tr><th rowspan="2">Sustainability objectives
and related issues of concern</th><th colspan="4">Who (main actor)</th><th colspan="3">Context</th><th colspan="6">Project-Process Phase</th><th colspan="4">Life Cycle Stage</th></tr>
<tr><th>Client</th><th>Designer/engineer</th><th>Contractor/builder</th><th>Operator</th><th>Construction works</th><th>Neighbourhood</th><th>City/region</th><th>Strategic planning</th><th>Project definition</th><th>Design</th><th>Construction and handover</th><th>Operation and maintenance</th><th>End-of-life strategy</th><th>Production</th><th>Construction</th><th>In-use</th><th>End-of-life</th></tr>
<tr><td>H2 — Quality of cultural life
Consider to what extent the construction works will:
— preserve, restore, or highlight existing cultural heritage, including natural and built environment, local traditions, and know-how;
— facilitate cultural life, exchanges, and diversity;
— provide easy access for everybody to social and cultural information networks;
— contribute to education of people to the environment and to sustainability.</td><td>X</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td></td><td>X</td><td></td><td></td><td></td><td>X</td><td></td></tr>
<tr><td>H3 — Security
— Identify potential risks for the construction works and their users.
— Ensure the works provide conditions for and give a sense of security for users, in all spaces, especially in outdoor spaces, during the day and night, including when accessing the works site (transport) and nearby services (shops, schools, etc.).
— Consider designs and technologies that offer personal and material security, data protection, and security against crime and vandalism, according to the identified risks.</td><td>X</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td></td><td></td><td>X</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td></tr>
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Table 4 *(continued)*

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H4 — Contribution to social equity and improvement in the social climate — Reduce potential for social tension or dispute through high quality design (e.g. good sound proofing between dwellings, equitable access to outdoor spaces and facilities) and/ or operability/operation and maintainability/ maintenance of common areas and equipment. — Minimize disturbances and nuisances on neighbours during construction and operation.	X	X	X	X	X	X			X	X	X	X			X	X	
H5 — Social and functional diversity — Facilitate social diversity in the project itself, or contribute to the social mix at the neighbourhood scale. — Contribute to the functional diversity in the project itself where appropriate, or contribute to the functional mix of the development at the neighbourhood scale.	X	X			X	X		X	X	X		X				X	

Table 4 — *(continued)*

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H6 — Socio-economic conditions — Through the project, facilitate the provision of jobs, if possible, permanent ones. — Contribute to improvement in education level and to development of professional skills. — Prevent social exclusion and combat poverty. — Encourage social cohesion, for instance between generations. — Ensure reasonable prices for purchase, rent, and/or services, or affordable/variable prices according to socio-economic conditions of the local population.	X	X	X		X	X		X	X	X		X			X	X	

Table 4 — *(continued)*

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I — Performance management during operation																	
I1 — Ability to operate and maintain — Ensure a detailed program of commissioning of services and systems is undertaken at the end of the construction phase. — Identify entities involved in operation and maintenance of the construction works. — Ensure design intentions and objectives and operational and maintenance requirements are understood by stakeholders. — Ensure that operation and maintenance staff (internal and/or external) have, as appropriate, the skills that are necessary to meet the requirements and achieve the objectives; if needed, develop a training plan. — Provide a user-friendly document, such as a manual and logbook, for operation and maintenance processes, procedures, and reporting; disseminate it to the operation and maintenance staff.	X	X	X	X	X				X	X	X	X			X	X	
I2 — Performance monitoring over time Create a plan for performance monitoring involving the following: — select appropriate indicators of performance (see ISO 21929-1:2011) covering environmental, economic, and social fields; — establish the target for each indicator; — determine measurement methods (e.g. by physical measurement, surveys, questionnaires, financial analysis, etc.) and frequency for each indicator.	X	X		X	X		X	X	X	X		X		X	X	X	

Table 4 — *(continued)*

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— Identify entities involved in collecting data and calculating indicators, and in assessing performance. — Ensure the assessment is objective and unbiased. — Use performance monitoring to assist in decision-making for operation and maintenance (see I1). NOTE Monitoring should aim to establish the absolute values, distance-to-target, and trends over time for each indicator.																	
I3 — Replacement and refurbishment strategy — Determine functions needed, and rank them in order of criticality. — Identify the level of performance and maintenance requirements for each critical function in addition to durability. — Collect service life data of system components in order to anticipate replacements. — Establish an initial replacement/refurbishment programme/strategy based on best available techniques/technologies, life cycle cost (LCC) analysis, and life cycle environmental assessment. — Review strategy at each decision point to ensure it remains technologically, environmentally, economically, and socially sound.	X	X		X	X			X	X	X		X	X	X	X	X	X

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
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I4 — Users' feedback and lessons from experience — Implement a programme for post-occupancy evaluation (POE). — Identify entity who receives user's POE feedback and how this will be used to improve both performance of the construction works and users' satisfaction. — Ensure that the received feedback is passed to organization/individual responsible for maintenance and operation of the construction works. — Ensure that decisions/actions proposed are environmentally, economically, and socially sound. — Ensure that users are informed of decisions made/actions taken in response to their feedback.	X		X	X	X	X		X			X	X			X	X	
I5 — User behaviour — Implement an energy, water, and waste management programme for users and maintain their awareness of this programme through ongoing appropriate communication and information. — Implement a behavioural safety programme to protect the health and safety of themselves and their colleagues. — Provide education and training to users about environmental, economic, and social impacts of their actions and behaviour, including any particular requirements in relation to the operation of the construction works.	X			X	X							X				X	

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
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J — Adaptability and end-of-life strategy																	
J1 — Adaptability for different uses — Specify to what extent the construction works should be adaptable to alternative uses on the long term. — Incorporate construction systems/elements that allow building elements to be modified, relocated, or removed. — Design the construction works such that there can be a change of use with little or no need to change the load bearing structure and main equipment/systems. — Consider specific adaptability principles of versatility, convertibility, and expandability. — Design to allow parts to be removed or upgraded without adversely affecting the performance of other parts of systems.	x	x		x	x	x			x	x		x	x		x	x	x
J2 — Ease of disassembly — Enable the products/systems to be easily taken apart and recovered at the end of its useful life. — Design demountable systems (e.g. modular, panelized, or prefabricated components). — Consider specific disassembly principles including accessibility, exposed and/or reversible connections, refurbishability, and simplicity. — For existing construction works, identify materials containing hazardous substances that can be released during disassembly and take appropriate measures to avoid health risks. — For new construction works, avoid using materials containing hazardous substances that can be released during disassembly.		x	x	x	x				x	x			x	x	x		x

Table 4 — *(continued)*

Sustainability objectives and related issues of concern	Who (main actor)				Context			Project-Process Phase						Life Cycle Stage			
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J3 — Recovery of materials for reuse, recycling, and energy recovery potential — Identify services in place in the local market that can provide a means for collection of recovered material for reuse, recycling, or for energy production. — Choose construction products/systems that are capable of being reused, recycled, or recovered for energy. — Give preference to the use of materials with inherent finishes, i.e. materials that can be left in their most basic state without an applied finish that can prevent reuse or recycling.		x	x	x	x	x	x			x		x	x	x		x	x
J4 — Adaptability in response to climate change — Establish weather data for the locality, considering future trends that might arise from predicted climate change. — Establish response strategy, through design or operation, that takes into account the projected range of future climate conditions.		x		x	x		x	x		x		x			x	x	

Annex A
(normative)

The nine general principles taken from ISO 15392:2008, Clause 5.3

A.1 General

The principles applied to reach the objectives are, without indication of importance and in alphabetical order

— continual improvement,

— equity,

— global thinking and local action,

— holistic approach,

— involvement of interested parties,

— long term consideration

— precaution and risk,

— responsibility, and

— transparency.

A.2 Continual improvement

This principle encompasses the improvement of all aspects of sustainability related to the built environment including the buildings and other construction works over time. It includes the performance of construction works as well as processes, and addresses means of assessment, verification, monitoring, and communication.

A.3 Equity

This principle encompasses the balanced and objective consideration of intergenerational, interregional, and intra-societal ethics, including environmental protection, economic efficiency, and social needs.

A.4 Global thinking and local action

This principle encompasses the consideration of the global consequences of local actions taking account of local and regional concerns, to ensure that

a) when acting locally, the regional and global relevance and consequences are considered and

b) when establishing and applying global strategies, the local implications, relevance, demands, and resources are considered.

A.5 Holistic approach

This principle encompasses the inclusion of all relevant and related aspects of sustainability when considering and assessing sustainability aspects of buildings and other construction works. A holistic approach addresses all aspects of sustainability over the life cycle of the building or other construction works.

A.6 Involvement of interested parties

This principle encompasses the taking into account of the contribution and requirements of interested parties relative to their respective areas of responsibility, and the timing of their involvement.

NOTE Due to the nature of the building and construction sector and its products, a wide range of stakeholders has interest in this industrial sector and its outputs. These stakeholders can demonstrate significant differences in their appreciation and understanding of the building sector. Such differences explain the multiplicity of views that exist in the interpretation of sustainable development in the context of building and construction, particularly in terms of scope, content, level of detail, priorities, etc.

A.7 Long-term consideration

This principle encompasses the taking into account of the short-, medium-, and long-term implications in decision making.

As a minimum, it includes the following:

a) performance over time (as the ability of fulfilling a defined level of function throughout the use phase);

b) life cycle thinking (i.e. considering the consequences of a choice made in one stage of the life cycle on the other stages);

c) legacy: the consideration of the impacts that are handed down as a result of development. The legacy can extend well beyond the physical boundaries of the development.

NOTE The legacy can be physical (e.g. the buildings and infrastructure), environmental (e.g. environmental benefit or damage), social (e.g. cultural heritage, skills, capacity building), or economic (e.g. employment, economic growth).

A.8 Precaution and risk management

This principle encompasses the avoidance of risks by applying the precautionary principle, or considering the most unfavourable impacts through risk management.

— Precaution (avoidance of risks): The precautionary principle aims to avoid risks; it sets concerns of future generations as the basis for the analysis of risk potentials.

NOTE Adoption of new technologies or new products should include a precautionary perspective without unduly compromising innovation.

— Risk management (management of identified risks): Risk management is a set of coordinated activities including risk assessment, risk treatment, risk acceptance, and risk communication.

A.9 Responsibility

This principle encompasses the moral responsibility for, rather than legal or financial consequences of, actions carried out by individuals or groups of individuals.

The development of local skills and institutional capacity supports the sustainability of construction works.

A.10 Transparency

This principle encompasses the presentation of information in a manner that is open, comprehensive, and understandable and, like the underlying data, traceable, with verifiable credibility.

NOTE For sustainability of buildings and other construction works, transparency relates to information about products as well as decision-making processes. For that purpose, an appropriate review and verification route of relevant documentation might need to be established.

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