
**Environmental management for concrete
and concrete structures —**

**Part 1:
General principles**

Management environnemental du béton et des structures en béton —

Partie 1: Principes généraux

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ISO 13315-1:2012

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 13315-1 was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 8, *Environmental management for concrete and concrete structures*.

ISO 13315 consists of the following parts, under the general title *Environmental management for concrete and concrete structures*:

— *Part 1: General principles*

A Part 2 on system boundary and inventory data is under preparation.

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Introduction

Environmental issues are now grave subjects for the human race. Fortunately, mankind has clearly recognized the nature of the problem and created the concept of “sustainable development,” which can be regarded as an environmental revolution. This concept means development that meets the needs of not only the present but also future generations without endangering the natural systems that support life on Earth, the atmosphere, the waters, the soils, and the living things, and at the same time acknowledging that global economic growth is a basis for future global welfare. The incorporation of the concept of sustainability is required in every aspect of social, economic, and cultural activities. The construction industry, which consumes enormous amounts of resources and energy to provide the infrastructure for the diversified activities of mankind, has a strong impact on the environment.

ISO has already published the ISO 14000 series on environmental management for goods and services as a system for improving the impact on the environment. This series of International Standards provides general rules for assessing the impact on the environment, as well as for environmental labels/declaration based on such an assessment. Meanwhile, ISO 15686-6 and ISO 21930 were formulated to tailor this series to structures. Whereas the former provides a basic framework for the procedures of environmental consideration for buildings and constructed assets, the latter presents a framework for environmental declaration in regard to building products.

Concrete is widely used as one of the key materials for constructing infrastructures such as buildings, bridges, dams, tunnels, etc., with its consumption being the second largest on the planet after water. While construction activities using concrete naturally entail adverse environmental impacts, they also provide environmental beneficial impacts. Improved infrastructures alleviate traffic congestion and prevent natural disasters. Also, the development of compact cities may control the expansion of adverse environmental impacts. Industrial wastes and byproducts from other industries are used as materials, fuels, and supplementary materials for producing cement. Accurate assessment of environmental impacts is therefore essential for minimizing adverse environmental impacts derived from construction activities using concrete while maximizing beneficial environmental impacts.

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Concrete structures consume large amounts of aggregates, cement and steel, which emit large amounts of CO₂ in their production processes. Concrete utilizes industrial waste and byproducts, and uses different aggregates in different regions. Concrete is delivered to the construction site in the form of partially finished products. Concrete structures are built in a wide variety of forms with specific requirements, used in various environments for a long time, and demolished, recycled and disposed of in various forms. The ISO 13315 series of standards is intended to provide the basic rules on environmental management for concrete and concrete structures having such characteristics. It is also intended to contribute to continued improvement of the environmental impacts resulting from the activities related to concrete and concrete structures. This series ensures consistency with the existing environmental ISO 14000 series, as well as ISO 15686-6 and ISO 21930. Figure 1 shows the relationship between the ISO 13315 series of standards, including those to be established in the future, and other existing ISO standards. Figure 2 shows the basic framework of the ISO 13315 series of standards.

The ISO 13315 series of standards covers all people involved in concrete and concrete structures: owners, designers, concrete manufacturers, constructors, users, certification bodies, and those who develop environmental standard specifications.

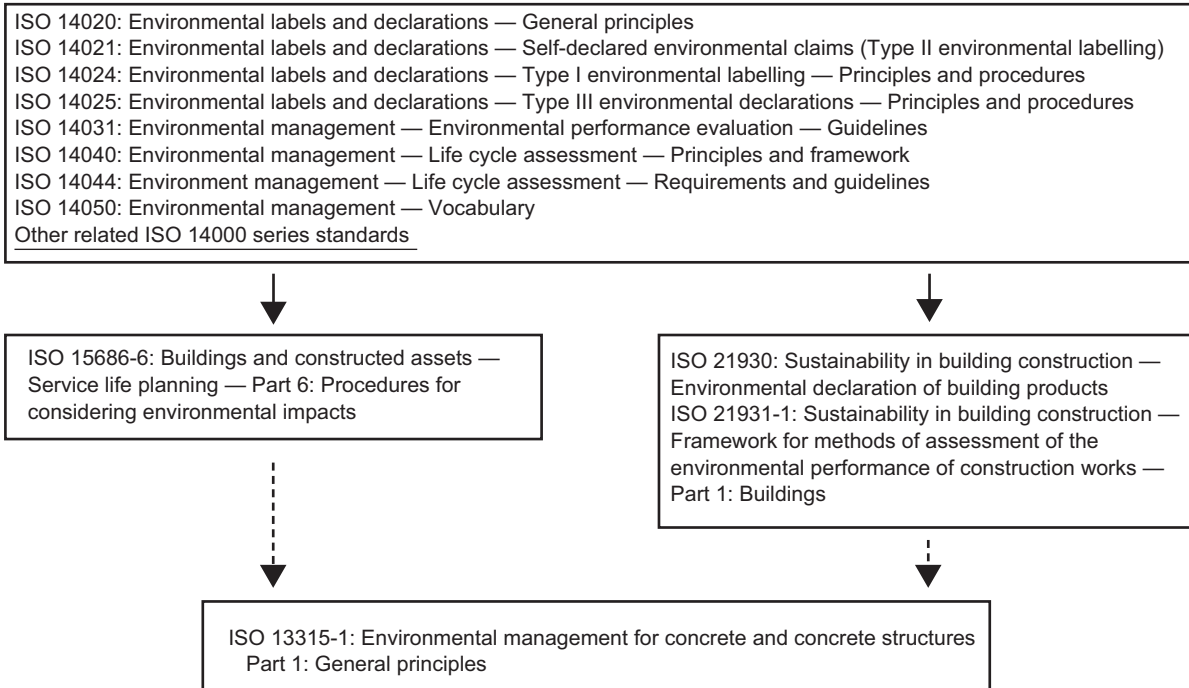


Figure 1 — Relationship between the ISO 13315 series of standards and other existing ISO environmental standards

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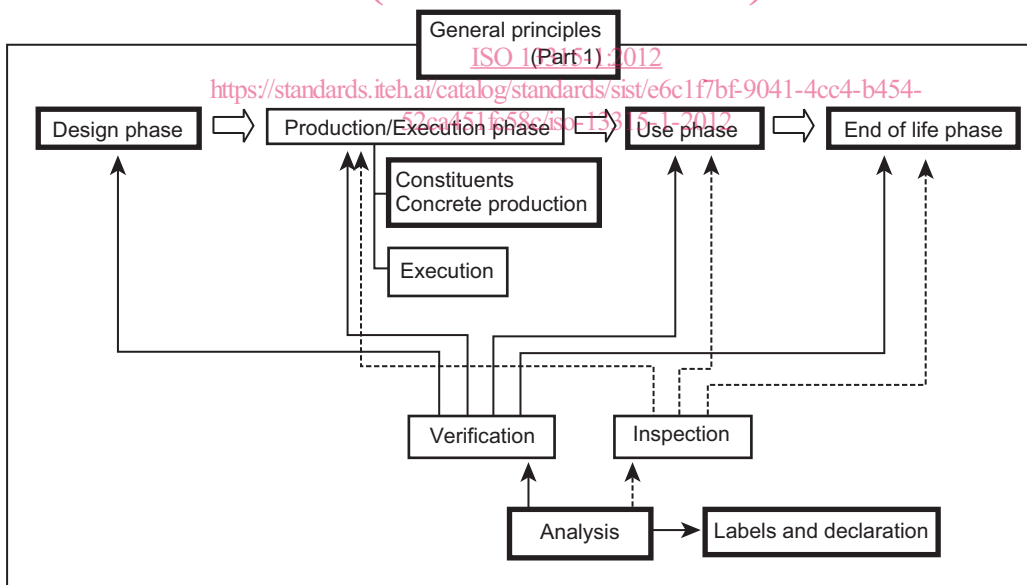


Figure 2 — Basic framework of the ISO 13315 series of standards

Environmental management for concrete and concrete structures —

Part 1: General principles

1 Scope

This part of ISO 13315 provides a framework and basic rules on environmental management related to concrete and concrete structures. This includes the assessment of the environmental impacts and methods of implementing environmental improvement based on the assessment.

This part of ISO 13315 is used when assessing the environmental impacts and implementing the environmental management of concrete and concrete structures for the environmental consideration in activities related to the production of concrete constituents, the production, recycling and disposal of concrete, and the design, execution, use and demolition of concrete structures. It is applied for their entire lifecycles, respective stages of the lifecycles, or certain ranges of the lifecycles. This part of ISO 13315 is relevant to newly produced concrete and newly constructed concrete structures, and also existing concrete and concrete structures.

This part of ISO 13315 applies not only to single concretes but also to concrete families and not only to single concrete structures but also to concrete structure complexes. For materials other than concrete, the related ISO standards are applied where available. In the case where no ISO standard is available, such materials are appropriately dealt with referring to this part of ISO 13315 and the normative references.

The environments covered by this part of ISO 13315 include global, regional and local environments. The indoor pollution of buildings and the environments for workers in concrete producing plants and on concrete structure construction sites are not specifically covered by this part of ISO 13315. This part of ISO 13315 does not directly deal with the environmental impacts resulting from the operation of equipment installed in concrete structures. However, the special properties of concrete and concrete structures affecting the operational efficiency of such equipment are considered in this part of ISO 13315.

This part of ISO 13315 covers secondary effects of the production of concrete and execution of concrete structures.

This part of ISO 13315 may also cover the economic and social effects of environmental consideration in the production of concrete and execution of concrete structures.

NOTE 1 ISO 16814 is available for reference as a standard for the indoor pollution of buildings.

NOTE 2 The working environments of plants and construction sites are generally prescribed by industrial safety and health laws.

NOTE 3 In buildings, global warming substances are mainly emitted from energy consumption due to the operation of heating, ventilating and air-conditioning equipment.

NOTE 4 The beneficial effects such as thermal mass and other functions of concrete and concrete structures may be taken into account.

NOTE 5 The secondary effects of the production of concrete include the future possibility of leaching of heavy metals from concrete or the absorption of heavy metals from the environment, the effect of waste treatments on the environment, etc.

2 Normative references

The following referenced documents are indispensable for the application 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 14050, *Environmental management — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14050 and the following apply.

- 3.1 byproduct**
secondary substances produced by an industrial process
- 3.2 client's brief**
working document which specifies at any point in time the relevant needs and aims, resources of the client and user, the context of the project and any appropriate design requirements
- 3.3 concrete demolition material**
material generated in demolition of concrete structures
- 3.4 ecosystem**
system of interrelations among nature, animals and human beings
- 3.5 environmental monetary cost**
costs necessary to fulfill environmental requirements
- 3.6 environmental design**
design of a structure in which environmental impacts are considered
- 3.7 environmental impact**
any change, which may be adverse or beneficial, to the environment, wholly or partially resulting from concrete-related activities
- 3.8 environmental performance**
quantitative or qualitative results of environmental influence from activities related to concrete and concrete structures
- 3.9 execution**
all activities carried out for the physical completion of the work, and the inspection and documentation thereof
- EXAMPLE Procurement, scaffolding, formwork, reinforcing, concreting, curing, erection of precast elements, etc.
- 3.10 global environment**
environment that is affected by global climate change, ozone depletion, changes in ecosystems, resource use and other factors on a global scale
- 3.11 inspection**
examination to determine whether environmental performance attained in a product or an activity satisfies specified requirements

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3.12**local environment**

environment that is affected by noise, vibration, dust and other factors in a built environment

3.13**regional environment**

environment that is affected by air pollution, soil contamination, or water pollution on an intermediate scale

EXAMPLE City, province and country.

3.14**sustainability**

state in which components of the ecosystem and their functions are maintained for present and future generations

NOTE 1 Sustainability is the goal of sustainable development and can result from the application of the concept of sustainable development.

NOTE 2 "Components of the ecosystem" includes plants and animals, as well as humans and their physical environment. For humans, this includes a balancing of key elements of human needs: the economic, environmental, social and cultural conditions for societies' existence.

3.15**soil contamination**

phenomenon in which soil is polluted by deleterious substances

3.16**verification**

process to check whether environmental performances estimated in a product or an activity satisfy specified requirements

3.17**waste**

unusable substances emitted from activities related to concrete and concrete structures

3.18**water pollution**

phenomenon in which water is polluted by deleterious substances

4 General framework**4.1 General**

The concept of sustainability through environmental management shall be considered in various activities related to the production of concrete and execution of concrete structures. In addition to the environmental aspect, sustainability has economic and social aspects which influence one another. Consideration of the environmental aspect may relate to the economic aspect such as environmental monetary cost. Consideration of the environmental aspect may relate to the social aspect, which involves issues of intergenerational ethics, such as securement of the quality of society and life, inheritance of tradition and culture, and consensus building for preserving ecosystems. The economic and social aspects of environmental consideration should therefore be clearly recognized in activities related to the production of concrete and execution of concrete structures, and these aspects may be appropriately considered based on the required priorities.

Environmental management of concrete and concrete structures shall be implemented with the aim of minimizing the adverse environmental impacts and maximizing the beneficial environmental impacts.

The objects of environmental management shall include the environmental impacts generated in the entire lifecycle of concrete and concrete structures or its phases including design, production, execution, use and end of life phase.

The basic flow of environmental management for concrete and concrete structures is shown in Figure 3. Environmental management shall be carried out with the Plan-Do-Check-Act process at the respective phases

of the concrete structures or through the lifecycle. This includes determining or confirming the types and values of environmental performance requirements; analysing the environmental performance of concrete, concrete structures and related activities, and verifying that the environmental performances satisfy or dissatisfy the required values; inspecting actual environmental performance during the respective phases or after them; and taking appropriate measures in the event of problems. The activities and their results shall be documented and the documents shall be stored.

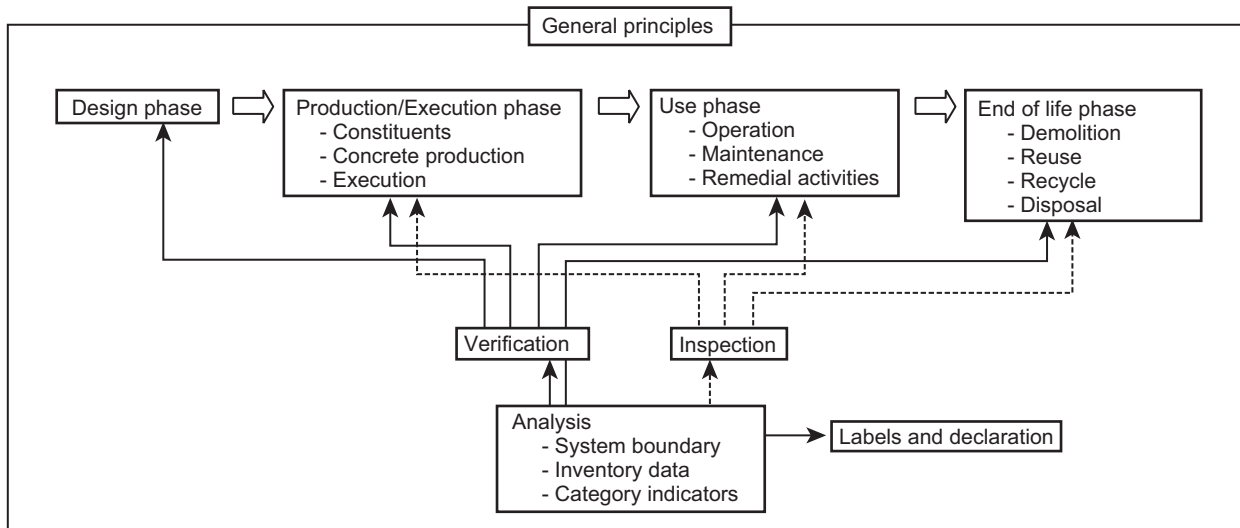


Figure 3 — Basic flow of environmental management for concrete and concrete structures

4.2 Phases in the lifecycle

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The lifecycle of concrete and concrete structures consists of the following phases:

- Design phase (4.5): phase in which the specifications of concrete structures are determined to satisfy the environmental performance requirements based on the client’s brief and legislation, and they are documented.
- Production/execution phase (4.6): phases including the manufacture of constituents, the production of concrete and the execution of concrete structures.
- Use phase (4.7): phase of operation and maintenance and remedial activities of concrete structures.
- End of life phase (4.8): phase of demolition of concrete structures, reuse of some elements, and recycling and disposal of concrete.

4.3 Environmental impact categories

The following items shall be considered as environmental impacts of concrete and concrete structures:

- global climate change;
- natural resources use (materials, water and fuel);
- stratospheric ozone level;
- land use and habitat alteration;
- eutrophication;
- acidification;

- air pollution:
 - smog (tropospheric ozone formation),
 - particulate matter air pollution,
 - other air pollution (toxics, etc.),
 - indoor air pollution;
- water pollution;
- soil contamination;
- pollution due to radioactive substances;
- impacts due to waste generation;
- noise/vibration.

When assessing the environmental impacts, it is necessary to appropriately judge if the range of the impact is limited to the local environment of the concrete structure or whether it reaches the regional or global environment.

NOTE The elements of environmental impacts generated at each phase of the lifecycle of concrete structures are shown in Annex A.

4.4 Analysis

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4.4.1 General

Analysis refers to calculation of the impact category indicators of concrete and concrete structures under certain system boundaries using appropriate indicators.

Analysis shall be carried out according to the following procedure:

- determination or confirmation of the system boundaries and impact category indicators;
- preparation of data corresponding to the impact category indicators;
- calculation of impact category indicators.

Analysis shall be conducted to verify the environmental performance of concrete or a concrete structure at each phase of its lifecycle and to inspect it at each phase except for the design phase. For the assessment of environmental performance, the system boundaries and indicators shall be appropriately determined. If the system boundaries and indicators have already been determined, their validity shall be verified.

The environmental performance shall either be assessed for the entire lifecycle, or a phase or phases of a lifecycle.

When using a specific tool, this tool shall be described and it should only be used after thoroughly understanding its characteristics.

4.4.2 System boundary

To determine the system boundary, the geographic range, time range, and the range of relevant industries shall be defined. It is necessary to reasonably define the ranges of input and output for the assessment of environmental performance of concrete and concrete structures for the lifecycle, or a phase or phases of lifecycle, as well as the service lives when assessing the environmental performance of concrete structures for their lifecycle.

Concrete may effectively utilize byproducts from other industries, such as ground granulated blast-furnace slag, fly ash and silica fume. Recycled concrete aggregate may be output to other industries. Therefore, the system boundary between relevant industries should be appropriately determined.