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Environmental management for concrete and concrete structures —

Part 2:
System boundary and inventory data

Management environnemental du béton et des structures en béton —

Partie 2: Limite du système et données d'inventaire

ICS 13.020.10; 91.080.40; 91.100.30

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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.

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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 13315-2 was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and prestressed 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*

— *Part 2: System boundary and inventory data*

Introduction

Concrete is a material that is indispensable for the construction of infrastructure including civil structures and buildings. Massive amounts of resources are used for construction of this infrastructure and large amounts of concrete rubble are generated when these structures are demolished. Concrete can therefore be regarded as a material having a critical impact on the formation of a recycling-based society from the aspect of not only resource consumption but also future waste generation. Meanwhile, a significant amount of CO_2, a greenhouse gas, is discharged from activities related to architecture and civil engineering. Various documents indicate that concrete sector is emitting 5 to 10% of the global CO_2 by producing and conveying cement and concrete and by construction of concrete structures. On the other hand, concrete can absorb CO_2. Concrete should therefore play an important role for solving the resource recycling and global warming problems. Consideration should also be given to the emission of air pollutants, noise, vibration, etc. during transportation of materials and concrete, and the construction and demolition of concrete structures.

Application of optimum environmental load-mitigating techniques and use of environmentally-conscious products are important issues for concrete structures at each stage of their lifecycle -- the production of cement and aggregate, the production and transportation of concrete, and the construction, use, and demolition of concrete structures. To meet these requirements, it is necessary to compare the environmental loads resulting from different concretes and also the structural forms, using lifecycle inventory analysis (LCI) and lifecycle assessment (LCA). LCI and LCA should be conducted under the same conditions. In other words, it is important to clearly define a temporal and geographical system range for assessment, and quantitatively grasp the types and amounts of resources, energy, constituents, and components input into the range, as well as the products and structures output as a result of activities within the range, and also the byproducts, waste, and other releases discharged. As shown in Figure 1, the boundary between the system under assessment and the outer region is referred to as a ‘system boundary,’ and the input/output data transferred between the assessment system and the outer region are referred to as ‘inventory data.’ When conducting LCI and LCA, a system boundary should be defined, and inventory data should be quantitatively developed. ISO 13315-2 provides fundamental rules for defining system boundaries and acquiring inventory data.

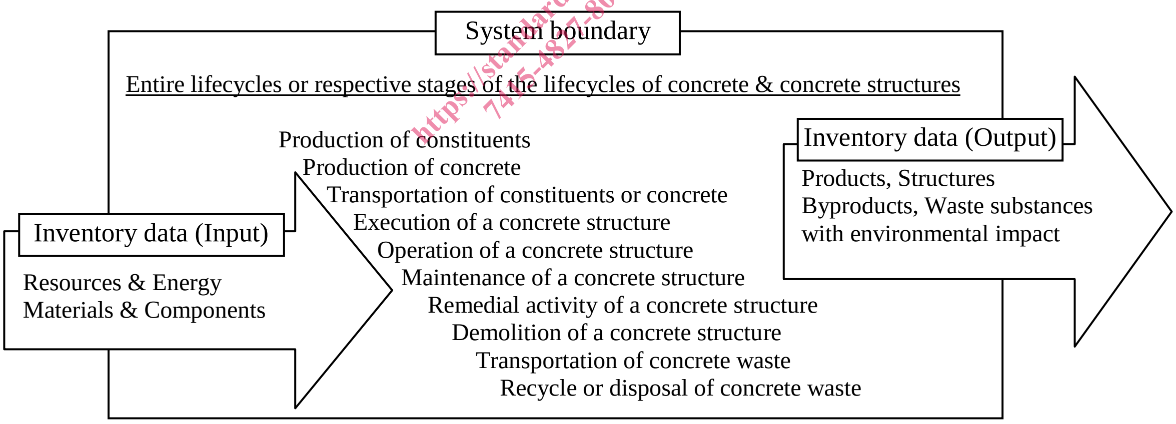

Figure 1 — System boundary and inventory data

Environmental management for concrete and concrete structures — Part 2: System boundary and inventory data

1 Scope

This standard provides a general framework, principles, and requirements related to the determination of system boundaries and the acquisition of inventory data necessary for conducting a life cycle assessment (LCA) of concrete, precast concrete and concrete structures.

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 13315-1, Environmental management for concrete and concrete structures — Part1: General principles

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 15686-6, *Buildings and constructed assets — Service life planning — Part 6: Procedures for considering environmental impacts*

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

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

3 Terms and definitions

For the purposes of this document, the following terms and those given in ISO 13315-1 and ISO 14050 apply.

3.1
input
resources, energy, materials or components which enter a product system

3.2
inventory data
a set of items that should be considered in a LCA, and the corresponding quantitative measurements

3.3
life cycle inventory analysis
phase of LCA involving the compilation and quantification of inputs and outputs, for a given product system throughout its life cycle

3.4
output
products, byproducts, wastes and other releases which leave a product system

3.5
system boundary
boundary between the system under assessment and the outer region

3.6
unit-based inventory data
inventory data per unit quantity in time, mass, length, area, volume, etc.

4 System boundary

4.1 General

When conducting an LCA of concrete or a concrete structure, its system boundary shall be demarcated. Demarcation of a system boundary means defining the range of consideration for the assessment. For comparison among multiple alternatives, the system boundary shall be the same for all alternatives. When the acquisition of inventory data is difficult or cost-constrained, the target data may be excluded from the system boundary, but the exclusion should be expressly indicated.

For system boundary demarcation, the life cycle stages and geographical system ranges to consider should be appropriately defined.

The system boundary of concrete and concrete structures shall delineate the ranges to be considered in the following activities: production of cement, water, additions, admixtures and aggregates, which are constituents of concrete; production of reinforcing steel; production of concrete; construction of concrete structures: use of concrete structures; demolition of concrete structures; reuse of concrete members; and recycling and disposal of demolished concrete.

It is not necessary in principle to include in the system boundary the environmental loads related to the production of equipment/machinery necessary for the production of concrete or the construction, use, demolition, and recycling of concrete structures.

NOTE When explicit consideration of environmental loads related to the production of equipment/machinery is deemed necessary, care must be taken to eliminate double counting or omissions.

Activities indirectly related to the production of each material or to the construction of concrete structures, such as sales/administration shall in principle be included in the system boundary.

4.2 Constituents

4.2.1 Cement

The system boundary related to the production of cement is generally expressed in Figure 2.

The system boundary for the production of cement shall include the following:

— the processes of quarrying, transporting, and treating raw materials necessary for the production of clinker;

— transportation of the fuel necessary for the production of clinker;

— all of the processes of material/fuel treatment, calcination, and finishing of cement;

— the process of additional treatment to byproducts used for the production of clinker;

— the process of additional treatment to waste-derived fuels for the production of clinker;

— transportation of cement from cement plants to supply stations (SS).

NOTE 1 The material/fuel treatment process includes crushing and adjustment of the materials/fuels.

NOTE 2 The finishing process includes clinker crushing and addition blending.

The system boundary for the production of cement shall not include the following:

— transportation of byproducts;

— transportation related to waste-derived fuels;

— transportation of cement from SS or cement plants to the place of use.

NOTE Byproducts for the production of clinker (slag, coal ash, sewage sludge, etc.) are generally supplied to cement plants at the expense of suppliers.

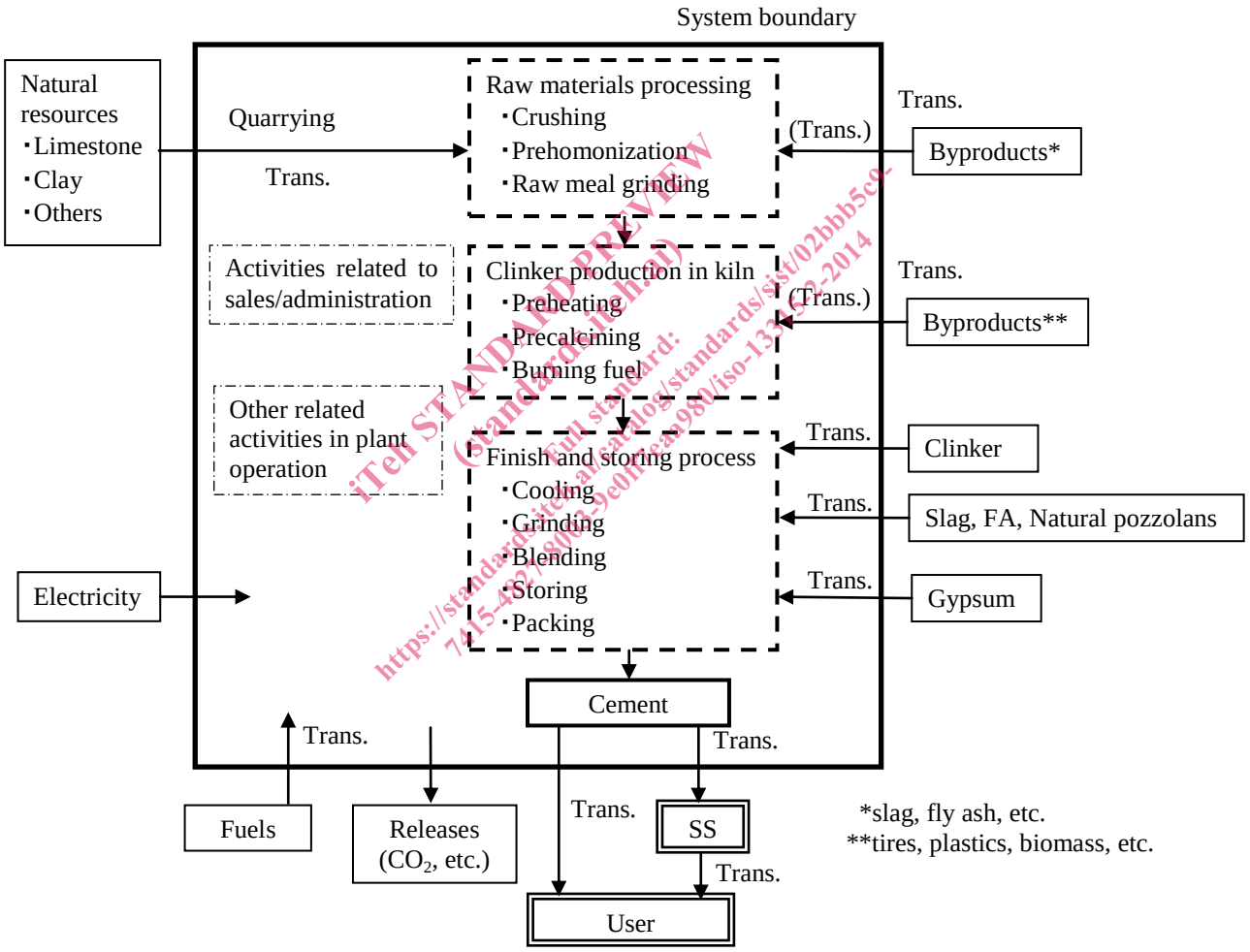

Figure 2 — System boundary of cement production

4.2.2 Additions and admixtures

The system boundary related to the production of additions and admixtures is generally expressed in Figures 3 and 4, respectively.

The system boundary for the production of additions and admixtures shall include the following:

— transportation, and storage of raw materials;

— transportation of fuels necessary for the production of additions and admixtures;

— physicochemical treatment of raw materials at addition and admixture production plants;

— transportation of waste to intermediate treatment sites and/or final disposal sites.

NOTE Since the combinations of raw materials for concrete admixtures widely vary, it is advisable to define the system boundary based on whether the raw materials are supplied at the expense of the user or the supplier.

Transportation of additions and admixtures from their production plants to the place of use shall not be included in the system boundary.

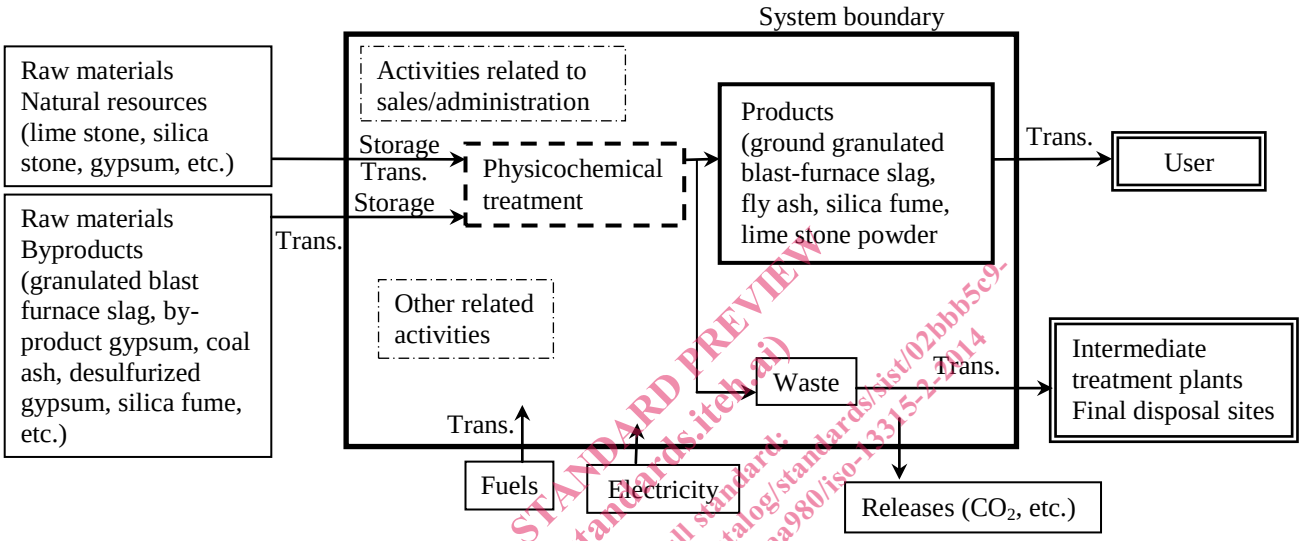

Figure 3 — System boundary of additions

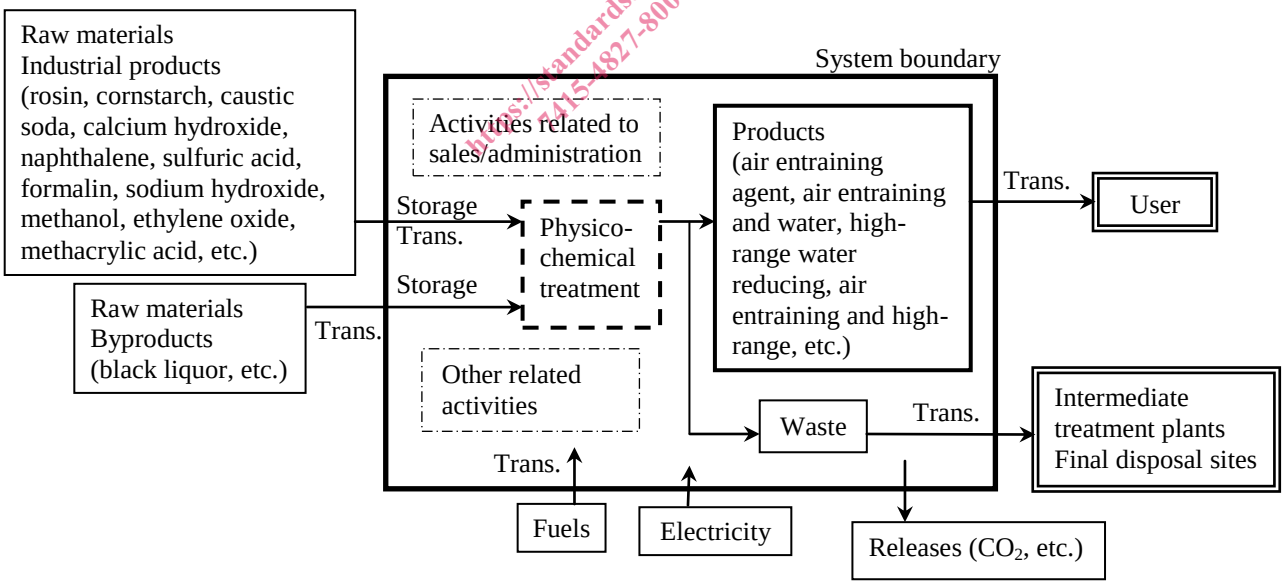

Figure 4 — System boundary of admixtures

4.2.3 Aggregate

The system boundary related to the production of aggregate is generally expressed in Figures 5, 6 and 7.

The system boundary for the production of aggregate shall include the following:

— mining and transportation of natural resources;

— transportation of fuels necessary for the production of aggregate;

— all processes related to the production of aggregate;

— transportation of waste generated in the process of aggregate production to intermediate treatment plants and/or final disposal sites.

The system boundary for the production of aggregate shall not include the following:

— transportation of crushed concrete and byproducts necessary for the production of aggregate;

— transportation of aggregate from aggregate production plants to the place of use.

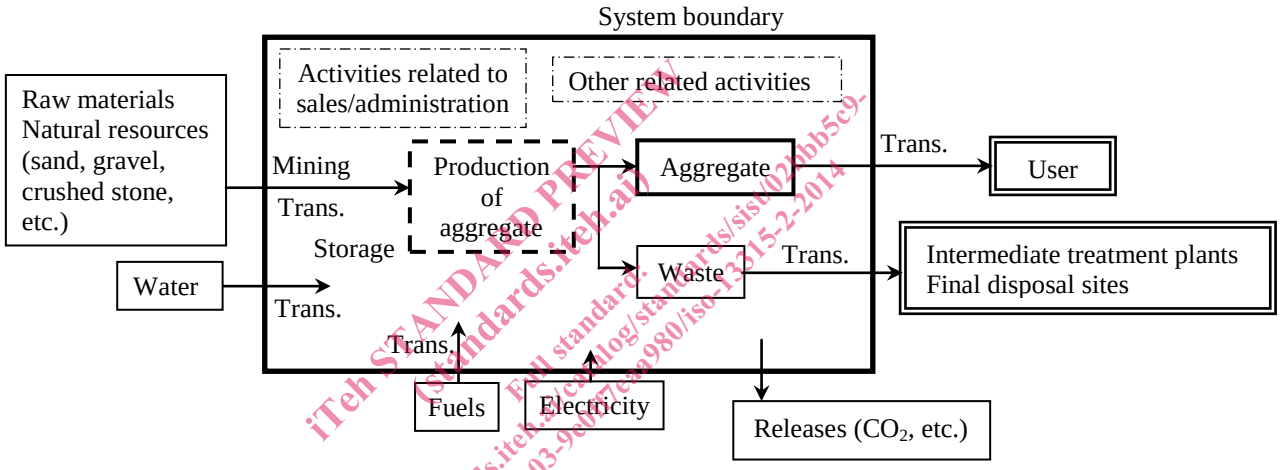

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Figure 5 — System boundary of sand, gravel, and crushed stone

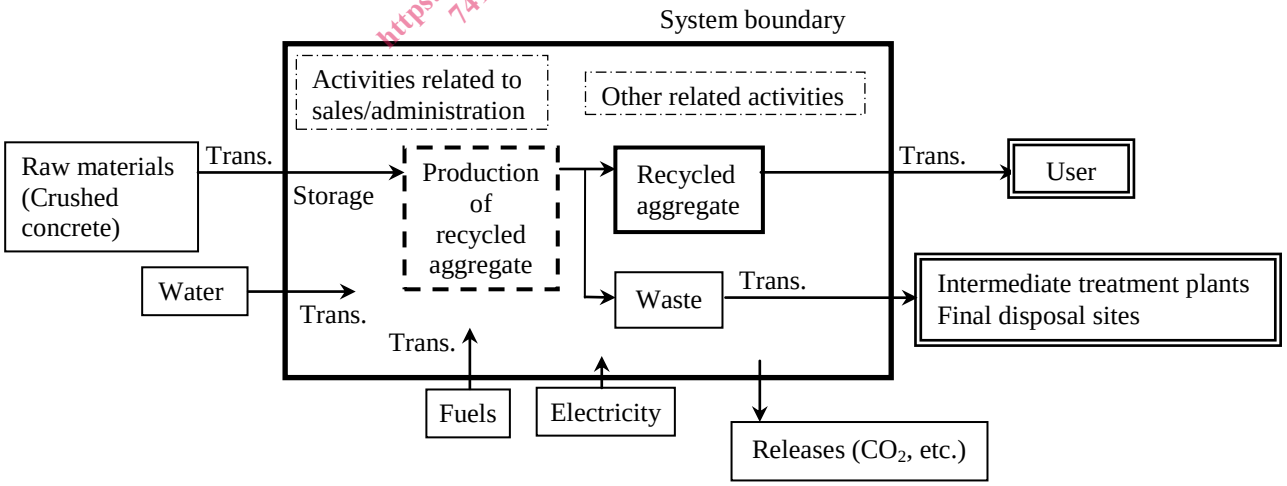

Figure 6 — System boundary of recycled aggregate