Infrastructure construction emissions database methodology

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Content

1 Purpose of the database

The *infrastructure construction emissions database* (co2data.fi/infra) has been developed at the Finnish Environment Institute (SYKE) on behalf of the Finnish Transport Infrastructure Agency in collaboration with experts in the life cycle assessment of construction products and buildings. The development work has utilized, where applicable, the *building construction emissions database* (co2data.fi/rakentaminen) previously prepared on behalf of the Ministry of the Environment.

The main objective of the infrastructure construction emissions database is to support the planning of low-carbon and resource-efficient infrastructure construction by providing open and typical environmental information on products and services to support the assessment and comparison of alternative design solutions. An open and public database enables the preparation of comparable assessments for various infrastructure projects, such as highway and urban construction projects.

The rules for calculating emissions from infrastructure projects are defined in the publication *Infrarakentamisen vähähiilisyyden arviointimenetelmä (43/2023)*[1] prepared by the Finnish Transport Infrastructure Agency.

This *infrastructure construction emissions database methodology* openly explains how the database's environmental data has been compiled and what sources have been mainly used in selecting the data. The methodology description also provides information on the structure and coverage of the database and supports the correct use of the data in the assessment of infrastructure structures and plans.

The content of the database will be updated and expanded regularly based on the feedback received in accordance with further development needs.

2 Database items

The national construction emissions database service CO2data consists of two databases: the building construction emissions database and the infrastructure construction emissions database. This methodology discusses the infrastructure construction emissions database.

The database contains information on slightly more than 1000 products and services. Construction products include numerous concrete products, steel and metal products, timber products, natural stone products and aggregates, plastic products and pipes, asphalts, paints, fuels and explosives, landscaping products and recycled materials. Services include various types of transportation and machinery.

The data units, or *items*, selected for the database have been considered to cover a significant part of the carbon footprint of construction.

The infrastructure construction emissions database has been implemented alongside the *building construction emissions database* However, the services are separate, although a few products and service items are common to both databases.

[1] Infrarakentamisen vähähiilisyyden arviointimenetelmä (vaylapilvi.fi)

3 Database information content

The database consists of numerical *indicators* that describe the environmental impacts of the database items. Up-to-date indicator values can be found directly in the database, and the justification for their compilation can be found in background reports.

The following subsections describe the types and accuracy of the database data, as well as the different indicators used.

3.1 Typical data

The database consists of so-called *generic* or *typical* data, the purpose of which is to represent the average level of Finnish construction as accurately as possible. This information describes, for example, the average value of a specific construction product, based on the specific information, e.g. *environmental product declarations* (EPD) presented by the relevant manufacturers in Finnish market. Often, accurate data on the market shares of different manufacturers' products in Finland is not available, so when determining typical values, considered assumptions must be made.

3.2 Global warming potential

The main indicator of the database is the *Global Warming Potential* (GWP). Its selection and definition have been carried out in accordance with the main principles of the EN 15804 + A2:2019 standard at different stages of the construction project life cycle, considering the limitations of the available information and the calculation method.

The database defines GWP values for various products, transportation and machinery in infrastructure construction. The indicator is called the carbon footprint, and it is defined as the total amount of greenhouse gases generated during the entire life cycle of the infrastructure, and its unit is kilograms of carbon dioxide equivalents (kg CO2e). The carbon dioxide equivalent considers the effects of all greenhouse gases converted to the equivalent effect of carbon dioxide.

The infrastructure construction emissions database only considers fossil GWP effects. Biogenic or land use and land use change (LULUC) GWP effects from construction products have not been considered so far.

The GWP of construction product manufacturing (A1-A3) is expressed in kilograms of carbon dioxide equivalents per kilogram of product (kg CO2e/kg) and possibly in other commonly used units such as m, m2 or m3. The value considers the life cycle stages: production of raw materials (A1), transport to the manufacturing site (A2) and the product manufacturing process (A3).

The GWP of transport services (A4) is expressed per load unit and transport distance (kg CO2e/t km). The GWP of machinery (A5) is expressed mainly per operating hour (kg CO2e/h), considering the assumed average operating power of the machine in relation to its maximum power.

3.3 Share of recycled materials

For construction products, the proportion of recycled material as a mass percentage (%) of the total mass of the product can be declared in the database.

3.4 Waste factor

The database defines a waste factor for construction products, which describes the typical material waste caused by the installation of the product on the construction site. In the case of prefabricated parts, the waste caused at the factory is described. The factor is expressed as a decimal number, which typically varies between 1 and 1.15. The factor describes the ratio of the material consumed in the work and the material bound to the structure. A factor of 1 means that no waste is generated.

3.5 Other general information

For each item in the database, a few general data fields are presented, which are: version, ID and background report. The version field presents the version of the database in which the item information was last updated. The ID field provides a unique, unchangeable identifier for each item in the database. The background report field provides a link to the background report, where a more detailed description of the item can be found, as well as the background for determining its values and the justification for the choices. The background reports are also version-numbered, which is evident from the name of the report downloaded. For some of the items in the database, the background may be given directly in the database without separate background reporting.

A harmonized product standard[2] (hEN) and the related Infra 2015 product categories can be presented for a construction product item.

3.6 Accuracy of values

The accuracy of the values of the indicators declared in the database is determined according to the rules of following table.

Table 1. Accuracy of the indicator value.

Value	Roundening	Result
x = 0	integer	0
0 < x < 1	2 significant digits	e.g. 0.00025, 0.40 tai 0.99
1 ≤ x < 10	1 decimal	e.g. 1.0, 6.2 tai 9.9
10 ≤ x	integer	e.g. 10 tai 137

[2] Harmonisoitu tuotestandardi hEN - henHelpdesk

4 Creation of information content

The database has been prepared in cooperation with representatives of manufacturers of different product groups and other experts, aiming to consider for each product group those key products whose mass share in the overall infrastructure is sufficiently large in terms of significance for the calculation of the carbon footprint.[3]

The following paragraphs present the sources of the database's information, its relevance, the method of information creation and its maintenance.

4.1 Information sources

Information on construction products is retrieved using the ECOPlatform[4], which brings together over 20 different EPD databases, including:

- Environdec
- EPD HUB
- RTS EPD (Rakennustieto)
- EPD norge
- IBU

Information is also retrieved directly from these EPD databases, and from manufacturers' product pages. Information is also compared with other generic databases, such as:

- Klimatdatabasen (boverket)
- Ökobaudat

Generic data is also utilized, where appropriate, from other European and international sources, such as:

- Plastics Europe
- European Aluminium
- Copper Alliance
- Eurobitume
- EFCC model EPDs

The data source for transport services and machinery has been LIPASTO, which is a *Finnish open transport unit emissions database*, which covers road, rail, water and air transport as well as machinery. The basis for the machinery emission data is LIPASTO's *Finnish machinery emission calculation model*, or TYKO, and its calculation methods A, B, C and D. Emissions from the fuel supply chain have been added to the LIPASTO values in accordance with the *JEC Well-To-Wheels report*[5].

4.2 Information relevance

When assessing the relevance of the information, special attention is paid to the domesticity of the information, since the domesticity of construction materials and services is typically high. Other Nordic results are also useful, because there are similarities

[3] Infrarakentamisen kansallinen päästötietokantahanke (doria.fi)
[4] ECO EPD Programmes - Eco Platform en (eco-platform.org)
[5] JRC Publications Repository - JEC Well-To-Wheels report v5 (europa.eu)

between the countries, especially in the manufacturing methods and markets of many construction products, although there are differences in energy systems compared to Finland. For some products with a high import, EPDs from foreign manufacturers can describe the Finnish market well. Other, mainly European, information sources are used if better market-specific information is not available.

EPDs according to the latest version of the standard EN 15804 are preferred.

4.3 Information creation method

The construction product item is created and updated in the database as follows:

1. The environmental and market data of the construction product are searched from different databases and other sources
2. The data are compared with each other and the relevance of the data is assessed
3. The best public data is selected, and a typical value is declared in one of the following ways:
    a. The most representative value or values are selected from the available data, on which the typical value is based
    b. If the data is very incomplete, the total emissions of the product can be estimated more roughly by other means, such as the emissions and weights of the product's most significant main materials (e.g. metals, plastics) or by comparison with similar products
4. When necessary, the views and comments of the manufacturers and experts of the product group are utilized, especially concerning larger updates
5. The updates are imported into the database approximately four times a year as follows:
    a. The product description and market data, reference sources assessed, and the justifications of the choices made, are updated in the background report
    b. The database is updated with the changes.

Creating and updating transport and machinery data is done in the same way, with an emphasis on other non-EPD data sources such as mentioned LIPASTO.

4.4 Information maintenance

The information content is maintained regularly and prioritized by category (e.g. asphalts, concrete and recovered materials), focusing on updating the data sources of the selected categories to the latest, and checking the assumptions and boundaries made. Maintenance takes place in interaction with experts of the field.

The information content can also be expanded if, due to feedback received or changes in the Finnish construction products market, it becomes clear that a typically used construction product is missing from the database.

Errors found in the database are corrected as a priority.

When the values in the database change, a new database version with changes is published, the versions of the updated background reports are updated, and the changes are noted in the change history presented in the CO2data service.