

Developing environmental load factors for construction materials used in social infrastructure LCA

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1. Background

If we are to introduce life cycle assessment (LCA) into the development of social infrastructure, we will need to establish a method of calculating environmental load arising throughout all processes from the extraction of resources to the manufacture, installation, commissioning, demolition and disposal of materials. Since environmental load is calculated as the volume of a material multiplied by its environmental load factor, we will need to develop environmental load factors covering all construction materials and energies, etc., used when developing social infrastructure.

We have prepared environmental load factors concerning CO₂ emissions and others for both general products and individual products. The aim is that these should enable construction industry operators to compare ordinary products (ordinary construction materials as pre-manufactured products) with individual products (specific products produced by individual factories and companies, special products), and to choose materials with a lower load by introducing LCA to social infrastructure.

2. Developing a list of environmental load factors for ordinary products

We calculated the environmental load factors of ordinary products using a method that combines the summation method with the input-output method. That is, we used the summation method to calculate load factors for “principal construction materials”, based on official statistics and others from which physical data can be obtained in categories of specific commodities. For other items, we complemented this with the input-output method. We selected steel, cement, asphalt blend, rubble, and others as elasticity markers for “principal construction materials”¹⁾. We then calculated their load factors and arranged them in a list (Fig. 1)²⁾.

By complementing this with the input-output method, we standardized system parameters (the range for calculating environmental load) into a range based on domestic economic activity. This enabled us to calculate load factors for different materials under the

same conditions. For principal construction materials, meanwhile, load factors can easily be updated by inputting the latest aggregated data.

3. Method of creating environmental load factors for individual products

We calculate environmental load factors for individual products using the summation method, which aggregates environmental load in individual manufacturing processes. To do this, we need to set a method of distributing system parameters and environmental loads common to materials. For principal construction materials, we studied and set system parameter and environmental load distribution methods, together with academics and professional experts in the field of materials and the environment (Fig. 2)³⁾.

Also, since the summation method involves an element of discretion in setting system parameters, for loads other than those subject to aggregated calculation, we made it possible to compare them with ordinary products by adding sector input-output tables and headings as “Estimates of unaggregated values”.

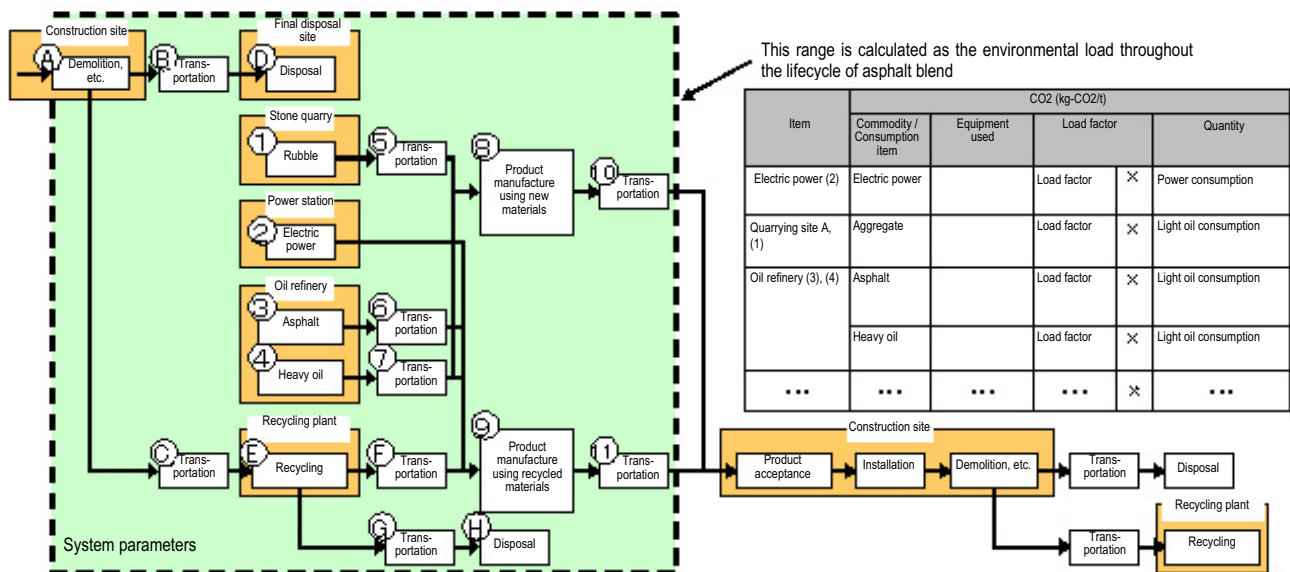
Name of commodity	Unit	CO ₂ emissions load factor			
		Total	Production	Shipment	Fuel used
Freshly mixed concrete, ordinary	m ³				
Freshly mixed concrete, early strength	m ³				
Freshly mixed concrete, blast furnace	m ³				
Concrete products	t				
Asphalt blend or mixture	t				
Recycled asphalt blend or mixture	t				
Rubble	t				
Recycled rubble	t				

Fig. 1 Example of commodities on an ordinary product environmental load factor list

Name of commodity	Unit	CO ₂ emissions load factor			
		Total	Production	Shipment	Fuel used
Light oil	m ³				
Blast furnace slag	m ³				
Steel plate	m ³				
Steel sheet pile	t				
Portland cement, ordinary	t				
Portland cement, early strength	t				
Blast furnace cement	t				
Fly ash cement	t				

Fig. 2 Example of system parameters

• System parameters of asphalt blend



4. Publication of results

The environmental load factors of construction materials used in social infrastructure will first be examined and verified by academic experts in the fields of materials and the environment, in a committee set up within the Japan Society of Civil Engineers. They will then be compiled into a Comprehensive Technical Development Project Report.

References

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