Dedicated to People Flow™

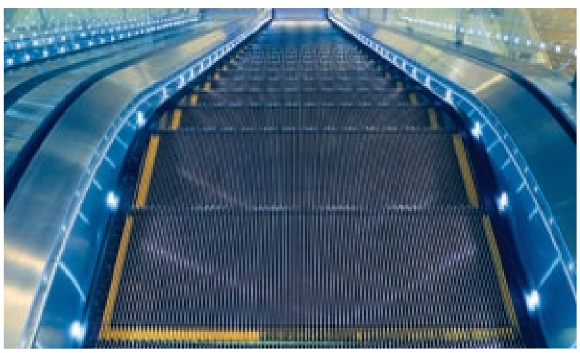
KONE TRANSITMASTER™ 140

Environmental Product Declaration

Environmental Product Declaration

General information

The Environmental Product Declaration (EPD) provides KONE customers information on the environmental performance of KONE products and services. The EPD is carried out according to the ISO 14025 standard. In addition, an ISO 14001-certified environmental management system is implemented in several KONE facilities. For the most up-to-date information on corporate responsibility at KONE, including environmental responsibility and management, see www.us.kone.com.



The results of this Environmental Product Declaration are valid for the KONE TransitMaster 140 escalator.

Product description	
Escalator type:	KONE TransitMaster 140 escalator
Segment:	Infrastructure
Rise:	60 ft. (18 m)
Inclination:	30°
Step width:	32 in. (800 mm), 40 in. (1000 mm)
Speed:	100 fpm (0.5 m/s)
Running direction:	50% upwards, 50% downwards
Operation:	20 hours/day, 7 days/week, 52 weeks/year, 20 years
Maximum capacity:	6,000 persons/hour
Weight of passenger:	165 lbs. (75 kg) (average value)
Maximum step load:	220 lbs. (100 kg) (related to maximum capacity)
Usage load profile:	0% – 1 h/25% – 12 h/50% – 5 h/75% – 2 h/100% – 0 h (total: 20 h)
Equivalent step load:	77 lbs. (35 kg)
Manufacturer:	KONE Inc.

Environmental performance

The Life Cycle Assessment (LCA) is a tool for assessing the environmental impacts associated with a product, process, or service throughout its life cycle. The LCA of the KONE TransitMaster 140 escalator was applied in compliance with the requirements of the ISO 14040 and ISO 14044 standards.

Functional unit
The function of an escalator is to give people access to multi-story buildings. The functional unit used is .63 mile (1 km) distance of escalator step band travel. The LCA results for the whole life cycle are also represented in this EPD.

System boundaries
The Life Cycle Assessment covers the most important environmental aspects related to raw material production, component manufacturing, delivery, installation, use, maintenance and end-of-life treatment, i.e. full-chain assessment. Transportation is included in all stages of the life cycle. The Life Cycle Assessment includes the consumption of raw materials and energy resources as well as emissions and waste generation.

The Life Cycle Assessment is based on an estimated lifetime of 20 years for the reference escalator, a KONE TransitMaster 140 operating 20 hours per day, 7 days per week, 52 weeks per year. The Chinese energy mix of energy sources for electricity production has been used for calculating emissions during the life cycle.

The total global recycling rate for metals is assumed to be 95%. Metals are recovered as scrap from manufacturing processes and from end-of-life treatment.

The data used in the Life Cycle Assessment is collected from the manufacturer and the suppliers as well as from LCA databases. If no suitable data was available, expert opinion or the best estimation was used.

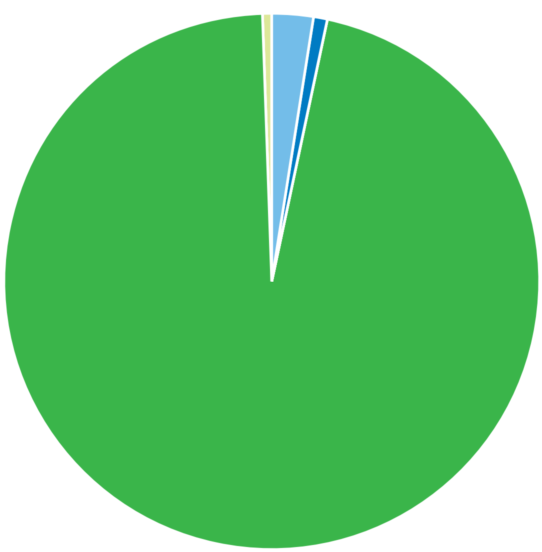
Most significant environmental impacts

About 98% of carbon dioxide (CO_2) emissions and 99% of nitrogen oxide (NO_X) and sulfur oxide (SO_X) emissions are generated during the use stage. By comparison, material production accounts for 1.7% of total carbon dioxide emissions, while component manufacturing accounts for 0.2%. About 98% of the total primary energy is consumed during the use stage.

Total primary energy and emissions to air		
	Values per escalator, with reference operation .63 mile (1 km) distance	Values per escalator for the whole life cycle
Total primary energy	100.4 MJ	26,324,245 MJ
Emissions to air		
CO_2	15 lbs. (6.50 kg)	3,757,050 lbs. (1,704,169 kg)
NO_X	2.41E-02 kg	14,000 lbs. (6,315 kg)
SO_X	5.28E-02 kg	30,500 lbs. (13,830 kg)
Particulates	5.01E-03 kg	2,900 lbs. (1,312 kg)

The Impact Assessment phase of LCA evaluates the significance of potential environmental impacts throughout the life cycle of the product. The share of the total environmental impacts of each life-cycle stage has been calculated using the Eco-indicator 99 (H,A) (EI99) impact assessment method and the factors of the CML impact assessment method. The absolute values of the impact assessment are not highly relevant because the main purpose is to compare the relative differences between products or processes.

The shares of the total environmental impacts of the life-cycle stages using Eco-Indicator 99 method



The stage of the life cycle	EI99 value-%
Material production	2.1
Component manufacturing	0.5
Delivery	0.001
Installation	0.003
Use	97.3
Maintenance	0.01
End-of-life treatment	0.03

According to the CML impact assessment and Eco-indicator 99 methods, the most significant environmental aspects of the escalator result from the use of fossil fuels for energy production, particularly hard coal and crude oil, and air emissions, particularly nitrogen oxides, sulfur oxides, particulates and carbon dioxide. The impact categories included are global warming, eutrophication, photochemical oxidation and acidification.

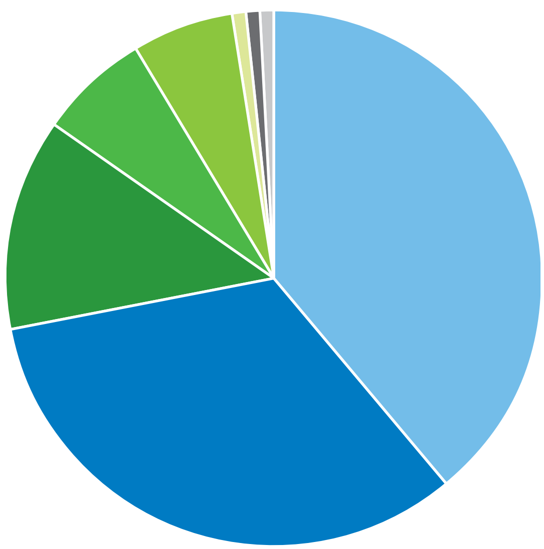
Emissions expressed in terms of environmental impact categories*			
Category of impact	Equivalent unit	Values per escalator, with reference operation .63 mile (1 km) distance	Values per escalator in the whole life cycle
Global warming (GWP100)	kg CO_2 eq.	7.64	2,001,880
Eutrophication	kg PO_4 eq.	3.18E-03	834
Photochemical oxidation	kg ethylene eq.	2.84E-03	745
Acidification	kg SO_2 eq.	7.52E-02	19,721

** Note that the impacts have different equivalent units.*
Values are calculated according to the factors of CML impact assessment method.

The Life Cycle Assessment shows that the biggest environmental impact during the escalator life cycle is caused by the electricity required to operate the escalator during the use stage.

Additional environmental information

Product material content
The KONE TransitMaster 140 escalator is mainly composed of coated and uncoated steel, and aluminum.



Material	Weight (%)
Steel (zinc coated)	39.0
Steel (uncoated)	33.0
Aluminum	12.6
Cast iron	6.7
Stainless Steel	6.2
Other	0.9
Plastics	0.7
Rubber	0.7

The product does not contain asbestos, paints containing lead or cadmium pigments, capacitors containing PCBs or PCTs, ozone layer-depleting chemicals such as CFCs, or chlorinated solvents. Mercury is not used in applications other than lighting. Cadmium stabilizers are not used in plastics.

A total of 27 lbs. (12.2 kg) of VOC emissions are released during the life cycle of the escalator. The majority of VOC emissions occur during material production (51.6%), component manufacturing (18.6%) and the use stage (29.8%).

Recycling description

The end-of-life treatment of the escalator consists of multi-metal scrap recycling. The metals, which represent about 98% of the escalator material weight, are recyclable. When metals are recycled there is a clear reduction in environmental impacts, primarily because the recycling of metals lowers the demand for primary metals as raw materials.

Packaging includes wood (37%), plywood (50%) and plastics and other materials (13%). Wood and plywood can be recycled or used for energy recovery. Plastics can be used for energy recovery or disposed of in landfills.

Sensitivity analysis

The electricity consumption of the escalator during the use stage (life cycle) under different operating modes affects the environmental results: stand-by mode decreases the total environmental impact by 8%.

Operating mode	Operational hours/year [h]*	Energy consumption/year [kWh]
Continuously running*	7 280	67 312 kWh
Standby speed with no passenger load	7 280	61 575 kWh

***Continuously running:** 20 h/day operation, 7 days/week, 52 weeks/year

Standby speed, no passengers: 19 h/day operation 1.6 f/s (0.5 m/s), 1 h/day operation .6 f/s (0.2 m/s), 7 days/week, 52 weeks/year

The effect of use location plays the biggest role when calculating the environmental impacts of the life cycle of the escalator. The total impact is approximately 62% smaller compared to the reference case (use in China) if the use location is in Europe. Use in the USA decreases the impacts by approximately 53% and use in the Middle East by approximately 21% compared to the reference case. These differences are a result of the different fuel mixes used for electricity production in different countries.

Glossary

Acidification potential
Chemical alteration of the environment, resulting in hydrogen ions being produced more rapidly than they are dispersed or neutralized; occurs mainly through fallout of sulfur and nitrogen compounds from combustion processes. Acidification can be harmful to terrestrial and aquatic life.

CML-impact assessment method
The CML methodology is based on midpoint modeling (problem-oriented method). Pollutants are allocated to impact categories.

Eco-indicator 99 (H,A) (EI99)
Damage factors in the hierarchist impact assessment method perspective. Pollutants are allocated to impact categories and are normalized by dividing the national total impact potentials. The environmental effects are then assigned to damage categories, which include the effects on human health, the quality of an ecosystem, and the fossil and mineral resources.

Eutrophication potential
Enrichment of bodies of water by nitrates and phosphates from organic material or the surface run-off, increases the growth of aquatic plants and can produce algal blooms that deoxygenate water and smother other aquatic life.

Exponential notation (E)
A way of writing numbers that accommodates values too large or small to be conveniently written in standard decimal notation, e.g. 7.21E-04 kg is equal to 0.0016 lbs. (0.000721 kg).

Functional unit
The quantified performance of a product system for use as a reference unit.

Global warming potential (GWP100)
The index used to translate the level of emissions of various gases into a common measurement to compare their contributions to the absorption by the atmosphere of infrared radiation. Greenhouse gases are converted to CO_2 equivalents with GWP factors, using factors for a 100-year interval (GWP100).

Ozone depletion potential (ODP)
The index used to translate the level of emissions of various substances into a common measure to compare their contribution to the breakdown of the ozone layer. ODPs are calculated as the change that would result from the emission of 2.2 lbs. (1 kg) of a substance to that from emission of 2.2 lbs. (1 kg) of CFC-11 (a freon).

Photochemical oxidation
The index used to translate the level of emissions of various gases into a common measurement to compare their contributions to the change of ground-level ozone concentration. POCPs are calculated as the change that would result from the emission of 2.2 lbs. (1 kg) of a gas to that from emission of 2.2 lbs. (1 kg) of ethylene.

Recycling rate
Metals recovered as scrap from manufacturing processes and scrap from end-of-life treatment.

Volatile organic compounds (VOC)
A wide group of organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize into the atmosphere. VOCs cause various environmental impacts that depend on the specific set of compounds released. VOCs primarily contribute to photochemical oxidation and respiratory organics.

This document has been developed in collaboration with VTT, Technical Research Centre of Finland. VTT is a contract research organization involved in many international assignments. With its more than 2,700 employees, VTT provides a wide range of technology and applied research services for its clients, private companies, institutions and the public sector. VTT is striving to improve the well-being of society and to enhance the technical and economic performance of its clients.

References

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ISO 14040: Environmental management. Life-cycle assessment. Principles and framework. 2006-12-18.

ISO 14044: Environmental management. Life-cycle assessment. Requirements and guidelines. 2006-12-18.

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