ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 & EN 15804:2012+A2:2019/AC:2021

Multiple-product EPD based on worst-case LCA results

BONDING KEY COATS

EPD Program	Title	Details
International Climate Intelligence System 71-75 Shelton Street Covent Garden, London, WC2H 9JQ United Kingdom office@climateintell.com	Registration Number	ICIS-202606-141
	Publication Date	18-06-2026
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	Revision Date	10-06-2026

Minotti Dry Mix Factory
Ras Al Khaimah, P.O. Box 85818
United Arab Emirates
www.minottidrymix.com

For the latest version and validity of this EPD within International Climate Intelligence System (ICIS), refer to www.climateintell.com.

Where surfaces need a stronger start,
Minotti creates the key that holds.

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OVERVIEW

This Environmental Product Declaration (EPD) presents verified, transparent environmental performance data for Bonding Key Coats, manufactured by Minotti Dry Mix **Factory** at its production facility in Ras Al Khaimah, United Arab Emirates. The declaration covers multiple products within the Bonding Key Coats product group, as listed below:

- MINO 100 **-** Bonding coat for rendering on normal fair-faced concrete surfaces.
- MINO 120 **-** Bonding coat for rendering on densified concrete surfaces.
- MINO 140 **-** Bonding coat for rendering on ultra-smooth concrete surfaces.
- MINO 150 **-** Bonding coat for rendering on impermeable or non-absorbing surfaces, including EPS/XPS.

In accordance with ICIS PCR 2026:18 v1.2.6 (EN 15804 + A2 aligned), the LCA results are calculated and reported using the worst-case product scenario within the declared product group. The declared unit for this assessment is 1 kg of Bonding Key Coats.

The life cycle assessment (LCA) follows the requirements of ISO 14025 and EN 15804:2012 + A2:2019/AC:2021, covering all relevant life cycle stages within the defined system boundary. This EPD supports architects, engineers, contractors, and sustainability consultants in making informed material selections by providing consistent, third-party-verified environmental information for use in green building certifications, embodied carbon assessments, and procurement decisions.

PRODUCT INFORMATION

Product Name
Bonding Key Coats

Product Type
Cement-based dry-mix bonding and repair mortar

Declared Unit
1 kilogram

PCR & Version
ICIS PCR 2026:18 v1.2.6
(EN 15804 + A2 aligned)

Scope
Cradle-to-Gate with options (A1-A4, C1-D)

Production Route
Dry-mix blending

Recycled Content
Not intentionally added (inherent recycled content only)

Electricity Mix
UAE grid mix from Ecoinvent 3.12 (cut-off). Natural Gas (69.32%), Hard Coal (18.70%), Nuclear (11.63%) and others.

LCA Tool and Database
Air.e.LCA v3.21.0.7 and Ecoinvent v3.12 (Cut-Off)

Geographical Scope
United Arab Emirates

PRODUCT INFORMATION

Verification

International Climate Intelligence System
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Product Group Classification

UN CPC code: 37540 – Non-refractory mortars and concretes

Environmental Performance Summary (A1-A3)

Indicator	Result	Unit
Climate change (GWP) - total	4.29E-01	Kg CO_2e
Climate change (GWP) - fossil	4.28E-01	Kg CO_2e
Ozone Depletion (ODP)	2.58E-09	Kg CFC-11e
Abiotic depletion of fossil resources	2.24E+00	MJ

Hotspot Summary

Process	Share of Total GWP (%)
Raw Material Supply (A1)	88.77
Raw Material Transportation (A2)	0.94
Manufacturing (A3)	3.40
Remaining Modules (A4, C1-C4)	6.89

PRODUCT INFORMATION

Where This Adds Value

Scheme / Area	Relevance to Bonding Key Coats
LEED v4.1 / v5 (USGBC) – MR Credit: EPDs	The Type III EPD supports MR credits for Environmental Product Declarations and contributes to whole-building life cycle assessment (LCA), enabling embodied carbon evaluation of cementitious bonding key coats used in UAE-based projects.
BREEAM International – Mat 01 / Mat 02	Provides third-party verified environmental data aligned with EN 15804, supporting Mat 01 life cycle impacts and Mat 02 responsible sourcing documentation for projects delivered in the UAE under BREEAM International schemes.
Estidama Pearl Rating System (Abu Dhabi) – SM Credit: Material Selection	Supports Estidama material transparency and LCA-based evaluation requirements, enabling informed selection of bonding key coats and surface preparation materials for Pearl-rated developments in Abu Dhabi.
Dubai Green Building Regulations (DGBR) – Materials & Resources Section	Supports material documentation and environmental performance reporting requirements under DGBR, facilitating approval of cementitious bonding key coats used in Dubai construction projects.
Infrastructure & Building Projects (UAE – DM, ADM, RAK Municipality)	Provides project-specific environmental data for bonding key coats used on concrete surfaces and selected EPS/XPS applications, supporting sustainable design, specification, and approval processes across UAE municipal authorities.
Procurement Transparency (UAE Contractors & Consultants)	Supports contractor and consultant requirements for verified environmental documentation in material submittals, technical approvals, and sustainability reporting across commercial and infrastructure projects in the UAE.

PRODUCT INFORMATION

UAE Net Zero 2050 & National Climate Reporting	Provides product-specific environmental data to support embodied carbon calculations and reduction strategies, enabling alignment with UAE Net Zero 2050 targets and national greenhouse gas reporting frameworks.

ABOUT MINOTTI

Minotti Dry Mix Factory is a UAE-based manufacturer specialising in premium cement and gypsum-based dry-mix products for building and construction applications. The company supplies factory-controlled dry-mix mortars in bags and mobile silos, supported by pneumatic conveying systems, automatic application machines, technical assistance, quality management, and reliable on-site performance across diverse project requirements.

Minotti Dry Mix Factory dry-mix products are widely used across building and construction projects in the United Arab Emirates, including residential, commercial, and infrastructure developments. Project outcomes include consistent material quality, reliable performance aligned with construction requirements, and efficient application using bagged supply, mobile silo systems, pneumatic conveying, and automatic application methods across diverse site conditions, supporting quality construction practices within modern building systems.

Key performance aspects include:

- Consistent material quality through controlled automated production.
- Reliable performance aligned with construction specifications.
- Compatibility with mobile silo and pneumatic conveying systems.
- Efficient site execution through automatic application machines.
- Application across diverse environments including residential and commercial projects.
- Successful use across varying project scales and construction conditions.

Minotti Dry Mix Factory products are recognised within the UAE construction sector for dry-mix technology, site efficiency, and reliable performance, supporting adoption across building and infrastructure projects. The brand is associated with quality-focused manufacturing practices and supports contractors through mobile silo delivery, automatic application systems, and technical assistance.

Key recognition aspects include:

- Established presence within the UAE construction industry.
- Acceptance across contractor and consultant networks.
- Proven performance in dry-mix mortar applications.
- Industry confidence supporting continued project adoption.

PRODUCT DESCRIPTION

Minotti Dry Mix Factory's Bonding Key Coats are cement-based dry-mix dash bonding coats formulated to improve adhesion, surface key, and substrate performance over concrete and selected non-absorbing surfaces. The product group includes the following products:

- **MINO 100** - Bonding coat for rendering on normal fair-faced concrete surfaces.
- **MINO 120** - Bonding coat for rendering on densified concrete surfaces.
- **MINO 140** - Bonding coat for rendering on ultra-smooth concrete surfaces.
- **MINO 150** - Bonding coat for rendering on impermeable or non-absorbing surfaces, including EPS/XPS.

Bonding Key Coats are applied as thin dash bond layers over prepared substrates and are compatible with manual application and mechanised plastering systems. The formulations consist primarily of limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, and other functional components that influence workability, bonding strength, surface uniformity, and durability. These Bonding Key Coats are designed for applications where substrate preparation and bonding performance are critical to the adhesion of subsequent plaster or render layers, supporting the development of prepared surfaces that provide a reliable key while maintaining compatibility with the underlying concrete or insulation substrate. Typical applications include render bonding, surface preparation, adhesion enhancement, and concrete background treatment across residential, commercial, high-rise, and infrastructure projects. The products are supplied in bags or mobile silo systems and mixed with water prior to application, enabling consistent performance across large-scale and site-based construction activities.

Sectors & Corresponding Uses

Sector	Application / Use Case
Residential Construction	Use in render bonding and surface preparation to improve adhesion and finish quality
Commercial Buildings	Application over normal, densified, or ultra-smooth concrete surfaces for reliable render bonding
Infrastructure Projects	Use in concrete surface preparation and bonding for structural and non-structural elements
High-Rise Developments	Application in manual or mechanised plastering systems to support fast execution and consistent quality

PRODUCT DESCRIPTION

Refurbishment & Maintenance Projects	Use in substrate preparation and adhesion enhancement before plaster or render application
EPS/XPS Insulation Applications	Use as bonding key coat over EPS/XPS and other non-absorbing surfaces for compatible render adhesion

Technical Specifications

Parameter	Details / Specification
Form	Powder, cement-based dry-mix bonding key coat
Mixing Method	Mixed with water at site prior to application
Application Thickness	Applied as a thin dash bonding coat over prepared substrates
Workability	Designed for easy application by manual or mechanised methods
Bond Strength	Provides strong adhesion between concrete surfaces and plaster/render layers
Application Method	Manual application, tyrolean box, spray hopper, or mechanised systems
Surface Function	Creates surface key and improves bonding for subsequent render application
Standards Compliance	Cementitious dash bond coat as per BS EN 13914-1, BS EN 13914-2, and ASTM C 926
Storage Conditions	Store in dry conditions in original sealed packaging, protected from moisture
Shelf Life	Typically 12 months under recommended storage conditions
Packaging	Supplied in 25 kg and 50 kg bags

MANUFACTURING DETAILS

The production of Bonding Key Coats is based on a controlled dry-mix manufacturing process using cementitious and mineral-based raw materials. The process begins with raw material handling, where key inputs such as limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, and other functional components are received, inspected, and verified for quality and conformity with internal specifications. Where required, coarse mineral materials undergo crushing to achieve the required particle size, followed by screening to ensure a consistent and controlled particle size distribution suitable for cementitious dash bond coat applications.

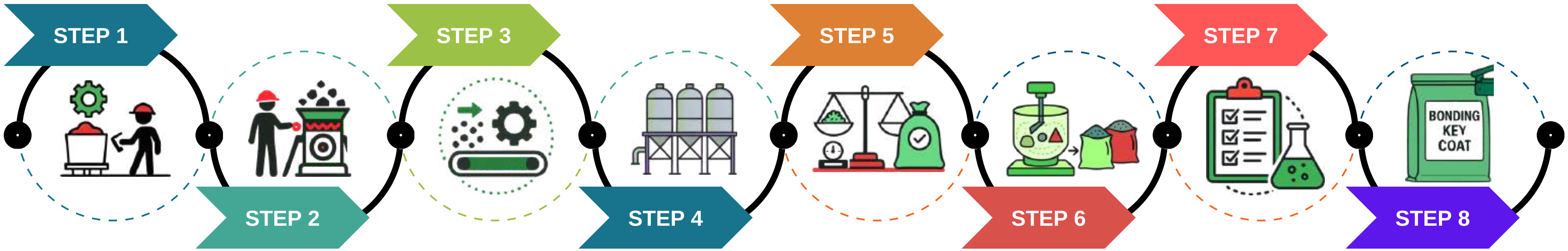
Processed materials are then transferred to dedicated storage silos or bins under dry, moisture-controlled conditions to maintain stability prior to production. During manufacturing, each raw material is accurately measured through automated dosing systems in accordance with the defined formulation and transferred to high-efficiency mixers. Controlled mixing is carried out to produce a homogeneous dry powder with uniform distribution of cementitious binders, mineral fillers, and functional additives required to support bonding performance, surface key, workability, and surface uniformity.

Representative samples are collected during and after mixing for quality control testing to verify consistency, workability, bonding performance, and compliance with product specifications. Following successful verification, the finished Bonding Key Coat product is transferred to the packing stage, where it is filled into bags or prepared for bulk silo dispatch, sealed, labelled, and made ready for delivery to site. The manufacturing process consists primarily of physical operations, including material handling, dosing, blending, quality control, and packing, with no intended chemical reactions occurring during production.

For a visual representation of the full manufacturing workflow, refer to the illustrated flowchart on the next page. A screenshot of the process flow for a representative Bonding Key Coat product, **MINO 140**, as modelled in the LCA software, is provided on the following page.

MANUFACTURING DETAILS

Schematic overview of Minotti's Bonding Key Coats manufacturing process



Raw Handling
Receiving, inspection, and storage of raw materials

Crushing
Size reduction of coarse materials to specification

Screening
Particle classification to achieve uniform size distribution

Storage
Controlled dry storage in silos for stability

Dosing
Precise weighing and proportioning as per formulation

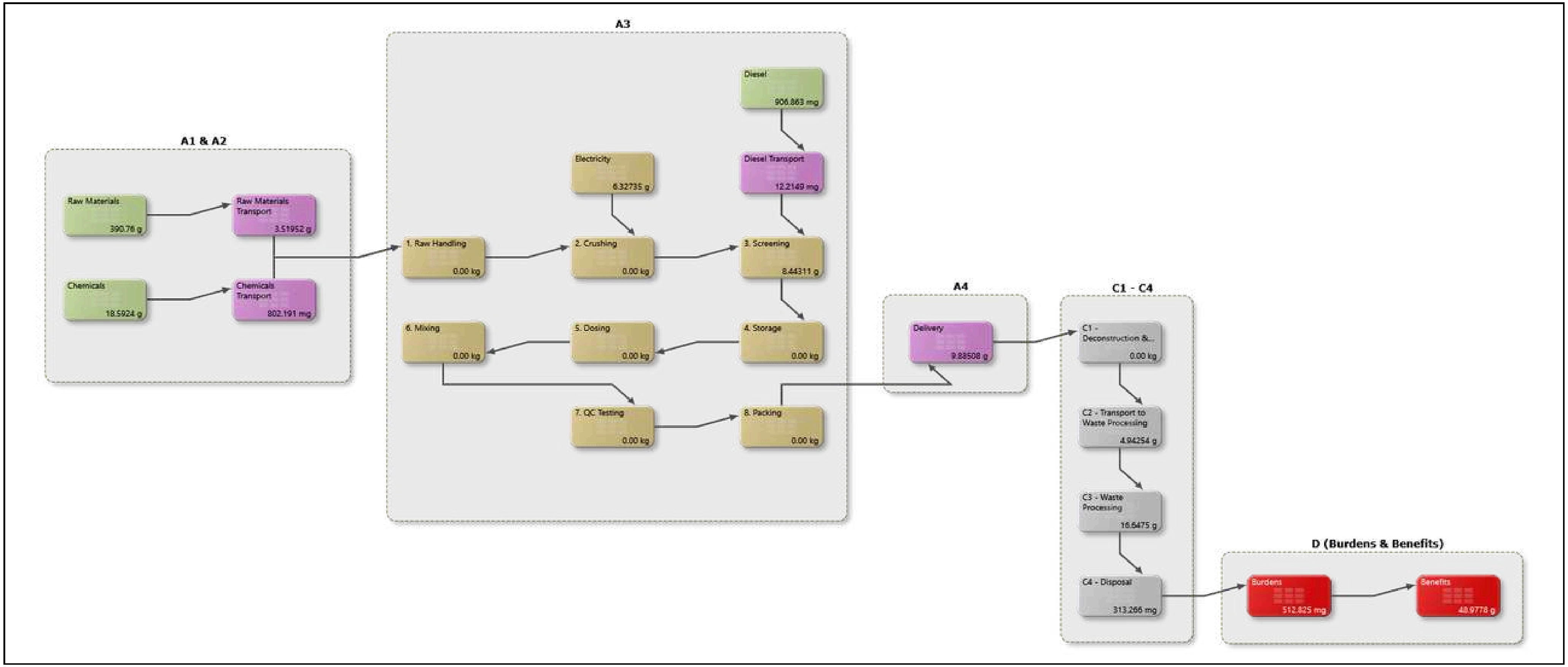
Mixing
Homogeneous blending of all constituents in mixers

QC Testing
Sampling and testing to ensure quality compliance

Packing
Filling, sealing, and labelling in protective bags

MANUFACTURING DETAILS

Screenshot of MINO 140 LCA model from LCA software



CONTENT DECLARATION

The content declaration provides a transparent breakdown of all raw materials used in the formulation of Bonding Key Coats, expressed per 1 kg of product. The formulation is primarily composed of limestone fillers and Ordinary Portland Cement (OPC), supported by polymer powders, cellulose-based additives, and small quantities of other functional components that influence workability, bonding performance, surface key, durability, and stability. The total of all listed components equals 1 kg, matching the declared unit and ensuring complete material accounting in line with EN 15804 and ISO 14025 requirements.

Component	Weight (kg/Declared unit)	Post-consumer recycled (%)	Pre-consumer recycled (%)	Biogenic Content (%)	Biogenic Carbon (kg C/DU)
Limestone	0.59	0	0	0	0
OPC	0.40	0	0	0	0
Polymer Powder	0.005	0	0	0	0
Cellulose Powder	0.0005	0	0	0	0
Total	**1**	**0**	**0**	**0**	**0**

Substances of Very High Concern (SVHC)

According to the requirements of the ECHA Candidate List, Bonding Key Coats contain no substances of very high concern (SVHCs) above the 0.1% (w/w) threshold in the final product or its ancillary materials.

All raw materials used in the formulation, primarily limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, and minor functional components, were reviewed against the latest published SVHC list at the time of reporting. Based on manufacturer declarations and available safety data, no SVHCs are present above the applicable threshold.

Packaging Material Declaration

Packaging materials used for Bonding Key Coats products include wooden pallets and paper bags. These materials serve distinct functions within the product supply chain—wooden pallets provide stability during handling and transport, while paper bags securely contain the dry-mix product and facilitate safe delivery to site. All packaging components are included in the life cycle assessment because they contribute to upstream manufacturing impacts and generate recoverable material streams at end-of-life.

Packaging Material	Biogenic Content (%)	Biogenic Carbon Fraction (kg C/kg material)	Notes & References
Wooden Pallet	~100% biogenic (solid wood)	0.50 kg C per kg wood (approx. 50% of dry mass is carbon)	Wood carbon fraction widely documented in forestry & IPCC (2006) guidelines — wood contains 50% carbon by dry weight
Paper Bags	~100% biogenic (paper fibre)	0.44 kg C per kg paper (44% carbon content)	Paper/pulp industry data and IPCC default values for lignocellulosic biomass

Wood and paper bags contain significant biogenic carbon because they originate from biomass. These biogenic fractions are reported for transparency and to reflect the renewable carbon temporarily stored in packaging materials. Their treatment in the LCA model follows EN 15804+A2 guidance, with flows presented in the Packaging Composition and Biogenic Carbon table below.

Packaging Material	Weight (kg/Declared Unit)	Share of Packaging (%)	Biogenic Carbon (kg C/DU)	End-of-Life Handling
Wooden Pallet	6.22E-03	67.47	3.11E-03	Reuse / Recycle / Energy Recovery
Paper Bags	3.00E-03	32.53	1.32E-03	Recycle
Total	**9.22E-03**	**100**	**4.43E-03**	**-**
Note - Biogenic content in packaging materials **exceed the 5% threshold** of the total packaging weight as stated in **ICIS PCR 2026:18**. Hence, these biogenic emissions are added in **module A3 and balanced out in module A5.**				

Declared Unit

The declared unit for this EPD is 1 kg of Bonding Key Coats at the factory gate. All material inputs, energy use, emissions, transportation, packaging, and end-of-life modelling are quantified relative to this unit. This ensures consistent comparison across life cycle stages and aligns with EN 15804+A2 requirements for construction products. No functional performance is assigned to the product in this declaration, as the EPD is based on a declared unit rather than a functional unit.

Temporal, Geographical and Technological Representativeness

Temporal Representativeness: Primary data for Bonding Key Coats reflects the reporting period January 2025 to December 2025, in line with EN 15804+A2 requirements that primary manufacturing data must be no older than five years. All on-site information, including raw material consumption, energy use, water use, and waste generation, represents current operational conditions at the Ras Al Khaimah facility during the defined reporting year. Background data used in the study are consistent with the temporal validity provided in their respective datasets to ensure alignment with the modelling year.

Geographical Representativeness: The LCA model for Bonding Key Coats reflects the actual manufacturing and supply conditions of Minotti's Ras Al Khaimah facility in the United Arab Emirates, where all primary data was collected. The study represents production and operations within UAE, with UAE-specific or GCC-specific conditions applied wherever available — particularly for raw material sourcing patterns, electricity grid characteristics, water production, and end-of-life treatment routes.

Where UAE-specific datasets or regional factors were not available, GCC-appropriate or globally representative datasets were used. All transport distances, energy consumption figures, and end-of-life scenarios are based on realistic practices in the UAE, ensuring geographical relevance of the final results.

Technological Representativeness: The manufacturing process modelled for Bonding Key Coats accurately reflects the actual production technology used at the Ras Al Khaimah facility. The product is produced through controlled batching and physical dry mixing of cement, limestone fillers, polymer powders, cellulose-based additives, and other functional components using industrial dosing and mixing equipment, followed by quality control and packaging operations. No intended chemical reactions, thermal processing, or high-temperature treatment occur during manufacturing. The technological assumptions used in the LCA are therefore representative of real operations at the plant, ensuring that the results reflect site-specific production conditions.

LCA Software & Database

The life cycle model for Bonding Key Coats was developed using Air.e.LCA v3.21.0.7, with all background inventory data sourced from Ecoinvent v3.12 (Allocation, cut-off by classification). The software was used to structure process flows, assign datasets, calculate environmental indicators, and perform all module-by-module inventory tracking. The database provides consistent, peer-reviewed life cycle inventories for raw materials, energy supply, transportation, and waste management processes. All datasets selected reflect technologies and supply chains relevant to the product and regional context, ensuring reliable integration of foreground data with established international life cycle inventories.

System Boundary

This EPD covers all product stages from “cradle to gate with options”, i.e. this LCA covers Production stage A1-A3, Transportation A4, End-of-life stages C1-C4 and Resource recovery stage D according to EN 15804:2012 + A2:2019 / AC:2021.

The procedures that are not controlled by the company, but are included in this environmental study, are:

- The extraction and production of fuels and electricity.

All related direct and indirect environmental impacts related to these elements have been calculated and were included in the LCA and this EPD. Personnel-related processes, such as transportation of employees to and from work is excluded. Also, the production and end-of-life processes of infrastructure or capital goods used in the product system are excluded.

Module A1 - Raw Material Supply

Module A1 encompasses all upstream processes related to the sourcing and preparation of raw materials used in the manufacture of Bonding Key Coats. The primary constituents—limestone fillers and Ordinary Portland Cement (OPC)—are sourced locally from Ras Al Khaimah within the United Arab Emirates, ensuring consistent quality and suitability for cement-based dry-mix formulations. Additional components such as cellulose-based additives are sourced from Germany, while polymer powders are procured from Germany and China in accordance with technical specifications and availability. Packaging materials including wooden pallets and paper bags are sourced within Dubai. All upstream activities such as raw material extraction, intermediate processing, and packaging of inputs are included within this module.

Module A2 - Raw Material Transportation

Module A2 covers the transportation of all raw and packaging materials to Minotti’s facility in Ras Al Khaimah, United Arab Emirates. The primary raw materials—limestone fillers and Ordinary

Portland Cement (OPC)—are sourced locally within Ras Al Khaimah and transported to the facility using >32-ton Euro 6 lorries, representative of bulk material transport within the region. Packaging materials including wooden pallets and paper bags are sourced from Dubai and delivered via similar road transport. Additional components such as cellulose-based additives and polymer powders are imported from Germany and China and transported via sea freight in containerised shipments to the UAE, followed by road transport to the manufacturing facility.

Environmental impacts in this module arise from fuel consumption associated with sea freight transport and domestic heavy-duty road transport. Transport distances, load factors, and logistics modelling reflect realistic supply chain conditions for both imported and locally sourced materials, ensuring representative accounting of inbound transport to the Ras Al Khaimah facility.

Module A3 - Manufacturing

Manufacturing impacts cover all processes required to convert raw materials into finished Bonding Key Coats at the Ras Al Khaimah production facility. Production follows a controlled dry-mix process comprising sequential stages: Raw Handling, Crushing, Screening, Storage, Dosing, Mixing, Quality Control, and Packing. These stages ensure accurate proportioning of cementitious and mineral constituents, homogeneous blending, and consistent product quality to achieve the specified bonding performance and durability characteristics required for construction applications.

Environmental loads in this module include electricity consumption for dosing, mixing, and packing operations; diesel use for internal material handling via forklifts and mobile equipment; and minor emissions associated with material transfer and handling. Additional impacts include negligible solid waste generation from packaging and routine operational activities, with waste streams managed through recycling practices. All direct emissions from electricity use, fuel combustion, on-site equipment operation, and material handling are included within the A3 system boundary.

Module A4 - Delivery

Module A4 accounts for the transportation of finished Bonding Key Coats from the Ras Al Khaimah manufacturing facility to customer locations. Since the products are supplied exclusively within the United Arab Emirates, all outbound transport occurs via road freight. Deliveries are modelled using Euro 6, >32-ton trucks consistent with Ecoinvent v3.12 cut-off system model assumptions, reflecting typical heavy-duty vehicles used for bulk construction materials in the region.

As a dry powder packaged in bags and palletised for shipment, the products are transported as consolidated loads with high capacity utilisation. Transport distances are based on representative average delivery routes within the UAE, covering distribution to construction sites, contractors, and infrastructure projects. Environmental impacts in this module include diesel consumption, tailpipe emissions, and load-dependent fuel use associated with outbound transport.

Scenario details	Description
Vehicle used for transport	Euro 6, >32 ton truck
Vehicle capacity	>32 tons
Fuel type and consumption	Diesel, 0.38 liters per km
Capacity utilization	100% as assumed in Ecoinvent v3.12
Bulk transportation	Mass of the transported product

C1 - Deconstruction and Demolition

Module C1 covers the impacts associated with the deconstruction and demolition stage at end-of-life. Minotti's Bonding Key Coats are cement-based materials applied as thin dash bond or coating layers over concrete surfaces and, in selected applications, EPS/XPS or other non-absorbing substrates. During use, the material becomes fully bonded to the host substrate or plaster/render system and does not remain as a separate recoverable component.

At the end of the service life, demolition activities are carried out using standard mechanical methods applied to the building element, such as breaking, removal, or crushing of concrete, plastered surfaces, rendered surfaces, or façade/insulation assemblies. The presence of Bonding Key Coats does not influence the demolition process in terms of equipment selection, energy demand, labour intensity, or operational requirements.

Consequently, no additional environmental burdens can be attributed specifically to Bonding Key Coats during deconstruction. The impacts associated with Module C1 are therefore considered negligible and are not assigned to the declared unit.

C2 - Transport to Waste Processing

Module C2 covers the transport of end-of-life materials from the demolition site to waste management facilities. Following demolition, Bonding Key Coats remain adhered to the host substrate and become part of mixed construction and demolition (C&D) waste generated from concrete surfaces, plaster/render systems, masonry elements, or selected EPS/XPS-based assemblies.

As the products are manufactured and used within the United Arab Emirates, the resulting demolition waste is managed within the national waste management system. The UAE has a well-developed network of C&D recycling facilities operated by entities such as Dubai Municipality, Tadweer in Abu Dhabi, and BEEAH in Sharjah, where mineral construction waste is processed into recycled aggregates. Across these systems, diversion rates for concrete and masonry waste typically range between 90% and 97%, supported by regulatory requirements and demand for recycled aggregates in infrastructure and civil works.

These recovery levels are consistent with those observed in countries with advanced C&D waste management systems, such as the Netherlands, Denmark, Belgium, Japan, and Singapore, where recycling rates commonly reach 90–99%. These international values are provided for contextual benchmarking only; the modelling approach is based on UAE-specific waste management practices.

Reflecting the established recycling performance in the UAE, it is assumed that 95% of the mixed demolition waste containing Bonding Key Coats is transported to C&D recycling facilities, while the remaining 5% is transported to inert landfill sites due to contamination, sorting limitations, or non-recoverable fractions. A one-way transport distance of 50 km is applied for both routes, representing typical distances between demolition sites and authorised waste management facilities within the UAE.

Transport is modelled using heavy-duty diesel trucks with a capacity greater than 32 tonnes, Euro 6 equivalent, consistent with standard life cycle inventory datasets for bulk mineral waste transport. Load utilisation and fuel consumption reflect typical operational conditions for construction waste logistics in the region.

Module C2 therefore accounts exclusively for the environmental impacts associated with fuel consumption and emissions arising from the transportation of mixed demolition waste to recycling and disposal facilities.

Type	Capacity utilization	Type of vehicle	Average distance
Truck	92%	Euro 6, >32 ton truck	50 kms

C3 - Waste Processing

Module C3 covers the processing of construction and demolition (C&D) waste before final disposal or recovery. At end-of-life, Bonding Key Coats remain adhered to the host concrete, plaster, render, masonry, or selected EPS/XPS-based substrate and therefore enter the waste stream as part of mixed demolition rubble rather than as separately recoverable products.

Within the United Arab Emirates, C&D waste is processed through established recycling infrastructure. In Sharjah, BEEAH's C&D recycling facility processes around 500,000 tonnes of construction and demolition waste annually into certified recyclable products, while in Abu Dhabi, Tadweer operates dedicated C&D materials recovery and crushing facilities that divert demolition waste from landfill and recover reusable materials for reintegration into infrastructure applications. In parallel, the UAE's Ministry of Climate Change and Environment has issued national requirements supporting the use of recycled aggregates from construction and demolition waste in roads and other infrastructure works, subject to quality verification.

In practice, the recycling route for this waste stream consists of mechanical treatment steps such as acceptance, sorting, crushing, and screening to produce recycled aggregate and fines suitable for further use. Hardened Bonding Key Coats follow this same mineral processing route and do not require any separate handling, treatment, or recovery operation of their own. This is because their contribution is minor relative to the host concrete, plaster, render, masonry, or mixed demolition waste stream and does not alter the configuration or efficiency of the recycling process. The description of crushing-based recovery is consistent with the UAE facilities cited above and with the country’s regulatory framework promoting recycled aggregate use.

Consistent with the scenario defined in Module C2, 95% of the mixed demolition waste containing Bonding Key Coats is assumed to enter recycling and waste-processing operations, while the remaining 5% bypasses recovery and proceeds directly to disposal in Module C4. Module C3 therefore includes the environmental burdens associated with the mechanical processing of the recyclable mineral fraction of the demolition waste.

C4 - Disposal

Module C4 covers the final disposal of materials that are not recovered through recycling processes. For Bonding Key Coats, this corresponds to the fraction of mixed construction and demolition (C&D) waste that is not suitable for recycling due to contamination, segregation limitations, or material quality constraints.

It is assumed that 5% of the mixed demolition waste containing Bonding Key Coats is directed to inert landfill facilities within the United Arab Emirates. This reflects typical outcomes in C&D waste management systems where a small residual fraction cannot be recovered through recycling or material recovery routes.

The disposed material consists primarily of inert mineral waste derived from crushed concrete, plaster, render, mortar, and masonry, with possible minor contributions from selected EPS/XPS-based assemblies depending on the application. Once cured, Bonding Key Coats behave similarly to hardened cementitious materials and exhibit negligible biodegradability, no potential for landfill gas generation, and very low chemical reactivity.

Inert landfill operations in the UAE involve standard activities such as placement, spreading, compaction, and dust control. As the material is non-hazardous and largely non-reactive after curing, environmental impacts associated with disposal are limited to operational activities at the landfill site.

Module C4 therefore includes only the environmental burdens associated with the handling and disposal of the non-recyclable fraction of mixed construction and demolition waste, with no additional emissions attributable specifically to Bonding Key Coats.

D - Reuse, Recovery & Recycling Potential

Module D reports the net environmental burdens and benefits associated with materials leaving the system boundary at end-of-life. These outcomes reflect the substitution of primary materials with secondary materials recovered through recycling, reuse, or energy recovery routes. For Bonding Key Coats, benefits arise from the recovery of the mineral fraction of demolition waste as well as from the recovery of associated packaging materials.

At end-of-life, 95% of the mixed mineral demolition waste containing Bonding Key Coats is assumed to be processed at construction and demolition (C&D) recycling facilities, where it is converted into recycled aggregates that substitute natural aggregates on a mass-equivalent 1:1 basis. In the United Arab Emirates, facilities operated by entities such as BEEAH in Sharjah and Tadweer in Abu Dhabi process concrete, mortar, plaster, render, and masonry waste into reusable aggregates for infrastructure applications. Reported recovery rates for mineral C&D waste in the UAE typically exceed 90–95%, supported by regulatory frameworks and demand for recycled materials.

These recovery levels are consistent with international best practices observed in countries with advanced C&D recycling systems, such as the Netherlands, Denmark, Belgium, Japan, and Singapore, where recycling rates for concrete and masonry waste commonly reach 90–99%. These benchmarks are provided for contextual reference only, while the modelling is based on UAE-specific practices.

Packaging materials are also considered under end-of-life recovery scenarios. Wooden pallets are assumed to achieve a 95% recovery rate, reflecting established industry practices of reuse, repair, and recycling. Studies on pallet lifecycle management, including work by the Virginia Tech and USDA Forest Service, report that approximately 95% of wooden pallets are diverted from landfill through reuse, repair, recycling, or energy recovery routes, supporting this assumption.

Paper-based packaging, including multi-wall kraft cement bags, is assumed to be collected and directed to recycling or energy recovery under controlled waste management conditions. According to industry guidance from organisations such as the American Forest & Paper Association and global paper recycling statistics, paper and paperboard recovery rates commonly exceed 65–70%, with higher recovery achievable in industrial or segregated waste streams.

Module D therefore captures the net environmental burdens and benefits associated with these recovery routes. Recycled mineral aggregates displace primary crushed aggregates; recovered wooden pallets offset virgin wood production or fossil fuel use when directed to energy recovery; and recovered paper materials substitute virgin paper fibre or contribute to energy generation.

The reported results in Module D represent the combined effect of the environmental burdens of recycling processes and the avoided impacts associated with the substitution of primary materials. These benefits arise from the broader waste management system and not from the Bonding Key Coats themselves, which are present as a minor fraction within the overall demolition waste stream.

Process	Unit (kilogram)
Collection process specified by type	
Bonding Key Coats in concrete collected as mixed mineral C&D waste	1
Recovery system specified by type	
Mineral demolition rubble sent for reuse / recycling as aggregate	0.95 (95%)
Mineral demolition rubble sent for energy recovery	Not applicable
Disposal specified by type	
Mineral demolition rubble sent to inert landfill	0.05 (5%)
Transportation assumptions	
Transport to recycling and landfill sites	50 km transport by Euro 6, >32 ton truck

System Boundaries Illustration

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction / installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction & Demolition	Transport	Waste Processing	Disposal	Reuse, Recovery & Recycling potential
Module	**A1**	**A2**	**A3**	**A4**	**A5***	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules Declared	X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	UAE	UAE	UAE	UAE	-	-	-	-	-	-	-	-	UAE	UAE	UAE	UAE	UAE
Share of specific data	GWP > 90%				-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	0%			-		-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	0%			-		-	-	-	-	-	-	-	-	-	-	-	-

X - Included, ND - Modules not declared.
**Module A5 is included to balance out biogenic emissions from packaging.*

LCA KNOWLEDGE

Cut-Off Rules

All relevant material and energy flows contributing to the manufacture of Bonding Key Coats have been included in the LCA model. More than 99% of the total mass, energy use, and environmental relevance is captured. Negligible flows—those that do not influence the overall results—are excluded.

The Polluter Pays Principle and the Modularity Principle are applied to ensure that impacts are assigned to the processes where they occur and that each life cycle stage is reported independently. No known data gaps or exclusions are expected to influence the robustness of the results.

Allocation

Allocation was applied only where shared energy inputs were used across multiple product lines at **Minotti**'s manufacturing facility. Electricity consumption, diesel use for internal handling, and water use were allocated using a mass-based approach, reflecting each product's proportional share of total annual production at the Ras Al Khaimah facility.

Raw materials—including limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, and other functional components—and all associated transport flows were modelled using product-specific primary data, as these inputs are directly dosed for Bonding Key Coats and do not require allocation. No economic allocation was applied, as the manufacturing process does not generate co-products.

Electricity

Electricity consumption in the LCA model is based on the UAE grid mix as represented in Ecoinvent v3.12 (Allocation, cut-off by classification). The UAE electricity supply is predominantly generated from natural gas, supplemented by coal, nuclear power, oil, and solar energy. The modelled grid composition is as follows:

Energy Source	Share (%)
Natural Gas - Combined Cycle Power Plant	39.78
Natural Gas - Conventional Power Plant	29.54
Hard Coal	18.70
Nuclear - Pressure Water Reactor	11.63

Oil	0.18
Solar Thermal (Parabolic Trough), 50 MW	0.17

The climate impact associated with this electricity mix is 5.19E-01 kg CO_2e per kWh, and this factor is applied consistently to all electricity use across modules A1–A3 and relevant downstream stages. This approach ensures that electricity-related impacts accurately reflect UAE operational conditions and the energy landscape relevant to **Minotti**'s Ras Al Khaimah facility.

Calculation Rules

The LCA model for Bonding Key Coats uses foreground data collected directly from the Ras Al Khaimah manufacturing facility, combined with background datasets sourced from Ecoinvent v3.12 (allocation, cut-off by classification). These datasets provide emission factors for key inputs, including limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, electricity consumption, diesel for internal handling, packaging materials, and transportation. Regionally representative conditions—such as UAE electricity mixes, supplier distances, and UAE-specific end-of-life practices—were incorporated where relevant to ensure representativeness.

Transport activities for raw material supply, packaging procurement, and finished product delivery are included based on actual supplier-to-plant and plant-to-customer distances. Road distances were measured using Google Maps, while sea freight transport is included for imported materials from Europe and Asia. Exclusions are limited to items of negligible relevance (<1%), such as administrative activities, office utilities, and capital equipment maintenance. Transport flows are therefore fully represented within the defined geographical scope.

Byproducts Assignment

No by-products are generated during the manufacturing of Bonding Key Coats. The process is a dry-mix operation involving physical blending of raw materials, with the only outputs being the finished product and minor process emissions associated with electricity use, internal material handling, and dust during transfer operations. As no co-products or secondary outputs are produced, allocation is not required within the manufacturing system boundary.


From modern routes to lasting finishes,
Minotti builds the bond beneath.

ENVIRONMENTAL PERFORMANCE

In the following tables, the environmental performance of the declared unit "1 kilogram of Bonding Key Coats" is presented for **Minotti Dry Mix Factory**. This EPD covers multiple products (MINO 100, MINO 120, MINO 140 and MINO 150) and is based on a worst-case scenario approach, with results corresponding to the product with the highest environmental impact, identified as **MINO 140**. Environmental impacts are calculated using EF 3.1 (ILCD), ensuring consistency with the applied life cycle impact assessment methodology.

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Core Environmental impact indicators

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding thresholds values, safety margins or risks.

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Climate change (GWP) - fossil	Kg CO_2e	4.08E-01	4.32E-03	1.57E-02	4.28E-01	9.88E-03	0.00E+00	0.00E+00	4.94E-03	1.66E-02	3.13E-04	-4.80E-02
Climate change (GWP) - biogenic	Kg CO_2e	0.00E+00	0.00E+00	1.62E-02	1.62E-02	0.00E+00	-1.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Climate change (GWP) - LULUC	Kg CO_2e	1.90E-04	2.17E-06	2.29E-06	1.95E-04	4.65E-06	0.00E+00	0.00E+00	2.32E-06	2.07E-05	1.77E-07	-1.41E-04
Climate change (GWP) - total	Kg CO_2e	4.09E-01	4.32E-03	1.57E-02	4.29E-01	9.89E-03	0.00E+00	0.00E+00	4.94E-03	1.66E-02	3.13E-04	-4.85E-02
Ozone depletion	Kg CFC-11e	2.21E-09	6.00E-11	3.10E-10	2.58E-09	1.40E-10	0.00E+00	0.00E+00	7.00E-11	2.80E-10	9.14E-12	-6.24E-10
Acidification	mol H+e	1.33E-03	2.00E-05	1.20E-04	1.47E-03	2.00E-05	0.00E+00	0.00E+00	1.00E-05	1.30E-04	2.16E-06	-3.18E-04
Eutrophication, aquatic freshwater	kg PO_4^{3-} eq	1.39E-04	9.19E-07	2.44E-06	1.42E-04	2.30E-06	0.00E+00	0.00E+00	1.15E-06	2.43E-05	8.47E-08	-4.66E-05
Eutrophication, aquatic freshwater	Kg P eq	4.52E-05	2.99E-07	7.95E-07	4.63E-05	7.50E-07	0.00E+00	0.00E+00	3.75E-07	7.93E-06	2.76E-08	-1.52E-05
Eutrophication, aquatic marine	Kg N eq	4.04E-04	8.36E-06	4.87E-05	4.61E-04	6.59E-06	0.00E+00	0.00E+00	3.29E-06	4.68E-05	8.60E-07	-9.69E-05
Eutrophication, terrestrial	mol N eq	4.46E-03	9.00E-05	5.30E-04	5.08E-03	7.00E-05	0.00E+00	0.00E+00	3.00E-05	5.00E-04	9.29E-06	-1.01E-03
Photochemical ozone formation	Kg NMVOC eq	1.32E-03	3.10E-05	1.64E-04	1.51E-03	3.82E-05	0.00E+00	0.00E+00	1.91E-05	1.61E-04	3.36E-06	-3.51E-04
Abiotic depletion, minerals & metals	Kg Sb eq	1.08E-06	1.20E-08	3.61E-08	1.13E-06	2.98E-08	0.00E+00	0.00E+00	1.49E-08	3.43E-08	4.70E-10	-7.80E-06
Abiotic depletion of fossil resources	MJ	2.03E+00	5.09E-02	1.65E-01	2.24E+00	1.22E-01	0.00E+00	0.00E+00	6.12E-02	2.29E-01	6.96E-03	-4.79E-01
Water use	m^3 depr.	4.72E-02	3.10E-04	1.10E-03	4.86E-02	7.97E-04	0.00E+00	0.00E+00	3.99E-04	5.78E-02	3.39E-04	-3.56E-02

The results of the environmental impact indicators — Abiotic depletion, Water use, and all optional indicators except Particulate matter and Ionizing radiation, human health — shall be used with care, as the uncertainties on these results are high or there is limited experience with the indicator. Reading example: 1.57E-03 = 1.57 × 10^{-3} = 0.00157.

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Additional environmental impact indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	Incidence	1.74E-08	3.82E-10	2.77E-10	1.80E-08	1.01E-09	0.00E+00	0.00E+00	5.05E-10	9.84E-09	5.06E-11	-7.66E-09
Ionizing radiation, human health	Kbq U-235 eq	4.51E-03	4.85E-05	1.30E-03	5.86E-03	1.25E-04	0.00E+00	0.00E+00	6.26E-05	2.62E-04	4.41E-06	-1.81E-03
Ecotoxicity (freshwater)	CTUe	9.39E-01	9.97E-03	2.29E-02	9.71E-01	2.47E-02	0.00E+00	0.00E+00	1.23E-02	9.73E-02	9.50E-04	-2.79E-01
Human toxicity, cancer effects	CTUh	3.51E-10	7.45E-13	1.60E-12	3.53E-10	1.58E-12	0.00E+00	0.00E+00	7.91E-13	3.48E-12	5.48E-14	-2.84E-10
Human toxicity, non-cancer effects	CTUh	2.48E-09	3.65E-11	4.73E-11	2.57E-09	9.47E-11	0.00E+00	0.00E+00	4.73E-11	1.42E-10	1.33E-12	-4.70E-10
Land use related impacts/soil quality	Dimensionless	2.86E+01	5.64E-02	1.39E-02	2.87E+01	1.55E-01	0.00E+00	0.00E+00	7.77E-02	2.73E-01	1.51E-02	-2.69E+01

This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure, or radioactive waste disposal in underground facilities. Potential ionizing radiation from soil, radon, and some construction materials is also not measured by this indicator.

GWP-GHG Indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG	Kg CO_2e	4.09E-01	4.32E-03	-5.11E-04	4.13E-01	9.89E-03	1.62E-02	0.00E+00	4.94E-03	1.66E-02	3.13E-04	-4.85E-02

This indicator includes all greenhouse gases, excluding biogenic carbon dioxide uptake and emissions, as well as biogenic carbon stored in the product, as defined by IPCC AR6 (2021). The indicator aligns closely with the Global Warming Potential (GWP) outlined in EN 15804:2012+A2:2019, incorporating updated characterization factors and environmental impact indicators.

Resource Use Indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	4.02E+00	8.21E-04	1.59E-03	4.02E+00	2.08E-03	0.00E+00	0.00E+00	1.04E-03	5.55E-03	7.19E-05	-3.73E+00
Renewable PER used as materials	MJ	4.84E-04	0.00E+00	1.08E-05	4.95E-04	0.00E+00	-4.95E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.51E-04

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Total use of renewable PER	MJ	4.02E+00	8.21E-04	1.60E-03	4.02E+00	2.08E-03	-4.95E-04	0.00E+00	1.04E-03	5.55E-03	7.19E-05	-3.73E+00
Non-renewable PER used as energy	MJ	2.03E+00	5.09E-02	1.65E-01	2.25E+00	1.22E-01	0.00E+00	0.00E+00	6.12E-02	2.29E-01	6.96E-03	-4.79E-01
Non-renewable PER used as materials	MJ	1.29E-06	0.00E+00	2.31E-09	1.29E-06	0.00E+00	-1.29E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.02E-06
Total use of non-renewable PER	MJ	2.03E+00	5.09E-02	1.65E-01	2.25E+00	1.22E-01	-1.29E-06	0.00E+00	6.12E-02	2.29E-01	6.96E-03	-4.79E-01
Use of secondary materials	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-02	0.00E+00
Radioactive waste	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Output Flow Indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for reuse	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.59E-01
Materials for recycling	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.50E-01	0.00E+00	9.59E-01

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Materials for energy recovery	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy - electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy - thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic carbon content

Details	Unit	A1-A3
Biogenic carbon content in product	Kg C	0.00E+00
Biogenic carbon content in accompanying packaging	Kg C	0.00443

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO2. "Reading example: 1.57E-03 = $1.57*10^{-3}$ = 0.00157"

Disclaimer: “According to the **EN 15804:2012+A2:2019** standard, the LCIA results are relative expressions translating impacts into environmental themes such as climate change, ozone depletion, etc. (midpoint impact categories). Thus, the LCIA results do not predict impacts on category endpoints such as impact on the extinction of species or human health. In addition, the results do not provide information about exceeding thresholds, safety margins or risks”.

Interpretation

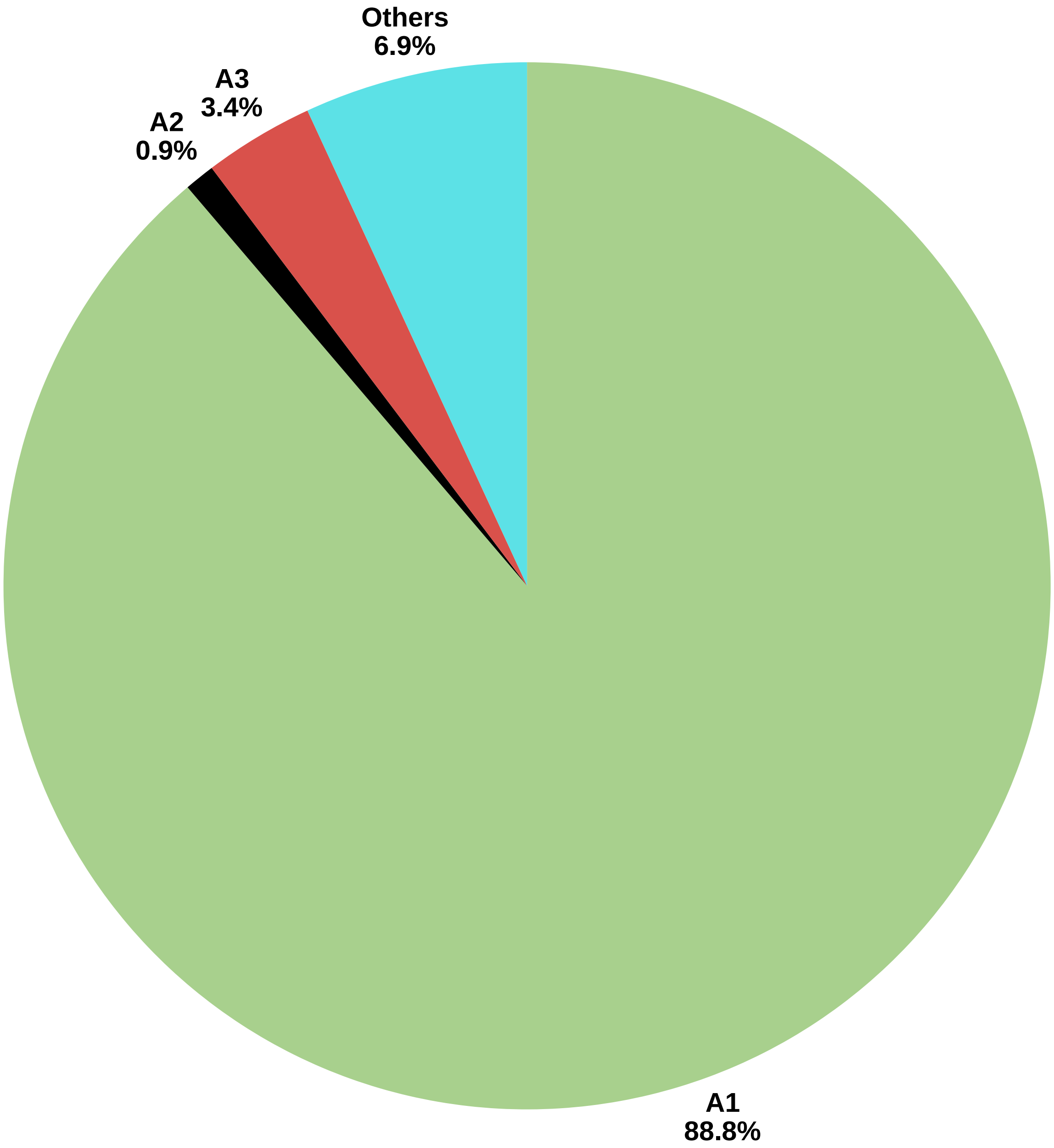
The life cycle results for **Minotti**'s Bonding Key Coats demonstrate a strongly raw-material-dominated environmental profile, with Module A1 accounting for 88.77% of total GWP. This distribution is primarily driven by the use of Ordinary Portland Cement (OPC), which remains the principal source of emissions in cement-based dry-mix formulations due to energy-intensive clinker production and process-related CO_2 emissions. Given the cementitious nature of Bonding Key Coats and the limited transformation during manufacturing, the environmental profile is fundamentally governed by upstream material inputs used to achieve bonding, surface key, workability, adhesion performance, and durability.

Module A3 (3.40%) and A2 (0.94%) remain significantly lower than A1, confirming that the product's environmental profile is not manufacturing-intensive. Manufacturing consists primarily of controlled dry-mix operations involving material handling, dosing, blending, quality control, and packing, with no thermal processing or intended chemical reactions. The low contribution from A2 indicates that inbound logistics are relatively limited compared with the dominant upstream burden of cementitious and mineral raw materials. Key inputs such as limestone-based fillers, OPC, polymer powders, cellulose-based additives, and other functional components contribute to product performance; however, their transport-related influence remains secondary compared with the upstream impact of cement-based raw materials.

Module A4 (2.14%) represents a modest share of total GWP, reflecting the distribution of Bonding Key Coats within the United Arab Emirates. As outbound logistics are based mainly on domestic road transport to construction sites, distribution-related impacts remain significantly lower than those typically associated with export-driven supply chains. Although the product may be supplied in bags or through mobile silo-based delivery systems, representative delivery distances and efficient load utilisation help contain the overall contribution of this module.

End-of-life modules show a moderate contribution, consistent with the behaviour of cementitious bonding key coats integrated into concrete, plaster, render, masonry, or selected EPS/XPS-based systems. C1 is zero, as the material becomes fully adhered to the host substrate and does not generate separate demolition burdens. C2 (1.07%) reflects transport of demolition waste to recycling and landfill facilities within the UAE, while C3 (3.61%) accounts for mechanical processing of mineral waste through crushing, separation, and screening operations at authorised facilities. C4 (0.07%) remains negligible, as cured cementitious material behaves as inert mineral waste and does not undergo biodegradation or generate landfill emissions. Overall, the impact distribution confirms a highly material-driven upstream profile with limited but visible influence from manufacturing, distribution, and end-of-life stages, reinforcing the representativeness of the model for UAE-based construction applications.

Life Cycle Stage Contribution to GWP (kg CO_2e per 1 kilogram of Bonding Key Coats)



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Mandatory Statements

Explanatory materials are available from the EPD Owner and/or LCA Author. The verifier and Program Operator make no claims and bear no responsibility regarding the legality of the study. Sole ownership, liability, and responsibility for the EPD lie with the EPD Owner. The LCA Author is not liable for manufacturer-provided information, life cycle data, or supporting evidence.

EPDs within the same product category, but issued by different EPD programs, may not be comparable. For valid comparison, both EPDs must be based on the same PCR (including version number), or on fully-aligned PCRs. Products must have identical function, technical performance, and use cases (e.g. the same declared or functional unit); share equivalent system boundaries, data descriptions, and data quality standards; use comparable collection methods and allocation rules; include matching content declarations; and be valid at the time of comparison.

Information related to EPD of multiple products

This EPD covers multiple products within the Bonding Key Coats product group, including **MINO 100**, **MINO 120**, **MINO 140**, and **MINO 150**. These products are grouped together because they share the same general function, similar cement-based dry-mix technology, comparable raw material families, common manufacturing process, and similar application route as dash bond/bonding key coat materials for concrete surfaces and selected non-absorbing substrates.

The declared results are based on a worst-case product scenario within the declared product group, represented by **MINO 140**. The worst-case approach ensures that the reported environmental performance is conservative and representative for all products covered under this EPD. Since the EPD reports worst-case results and does not claim ISO 21930 compliance, separate variation disclosure by product is not required.

Information related to Sector EPD

This is not a sector EPD.

Differences vs previous versions

This is the second version of the EPD. See next page for more details.

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EPD Version Information

Version	Date	Program Operator	Registration Number
Original Issue	20-05-2021	International EPD System	SP-03816
Revision 1	18-06-2026	International Climate Intelligence System	ICIS-202606-141

Total GWP Results Comparison (A1-A3)

Module	**Previous LCA** (ecoinvent v3.6) (kg CO_2e/kg)	**Updated LCA** (ecoinvent v3.12, cut-off) (kg CO_2e/kg)
A1	3.79E-01	4.09E-01
A2	5.85E-03	4.32E-03
A3	-5.62E-02	1.57E-02
A1-A3	**3.29E-01**	**4.29E-01**

The increase in A1–A3 GWP from 0.329 kg CO_2e/kg in the previous LCA using Ecoinvent v3.6 to 0.429 kg CO_2e/kg in the updated LCA using Ecoinvent v3.12 cut-off is primarily attributable to updated background datasets, revised system modelling, and improved allocation of process burdens, rather than any change in product formulation, raw material quantities, or manufacturing operations. The overall increase of approximately 0.100 kg CO_2e/kg is mainly driven by the change in Module A3, with an additional contribution from Module A1, while Module A2 shows a slight decrease.

The most significant variation occurs in Module A3, which changes from a negative value of -0.0562 kg CO_2e/kg in the previous model to a positive value of 0.0157 kg CO_2e/kg in the updated model. Under standard EN 15804 modelling practice, the manufacturing stage for cement-based dry-mix products is expected to show net positive emissions due to electricity use, internal material handling, dosing, mixing, packing, and other factory operations. The negative A3 value in the earlier model is therefore understood to result from differences in modelling assumptions, dataset structures, treatment of packaging-related biogenic flows, or allocation approaches in the previous database version, rather than representing actual physical manufacturing conditions. In the updated model, A3 reflects the direct manufacturing burdens more consistently, resulting in a more representative and conservative estimate of production-stage impacts. This change accounts for approximately 0.072 kg CO_2e/kg of the total increase.

Module A1 increases from 0.379 to 0.409 kg CO_2e/kg, representing an increase of approximately 0.030 kg CO_2e/kg. This reflects updated upstream datasets for key raw materials used in Bonding Key Coats, including OPC, limestone fillers, polymer powders, cellulose-based additives, and packaging materials. The Ecoinvent v3.12 update includes revisions across multiple background sectors, including fuels, electricity, chemicals, plastics, minerals, and material production. These changes can affect life cycle impact results even when the foreground formulation remains unchanged, due to revised emission factors, updated activity links, improved regionalisation, and changes in supply-chain modelling assumptions.

Module A2 decreases from 0.00585 to 0.00432 kg CO_2e/kg, representing a reduction of approximately 0.00153 kg CO_2e/kg. This indicates that the updated inbound transport modelling for Bonding Key Coats results in slightly lower transport-related impacts than the previous model. The reduction may arise from revised transport datasets, updated vehicle emission factors, improved fuel supply-chain modelling, route assumptions, or changes in road and sea freight background data within the newer database. However, A2 remains very small compared with the dominant upstream raw material contribution from A1.

Overall, the observed increase in A1–A3 GWP is technically justified and reflects improved data quality, updated background inventories, and more consistent accounting of manufacturing-stage burdens under the Ecoinvent v3.12 cut-off modelling framework. The updated results therefore provide a more robust, transparent, and conservative representation of Bonding Key Coats’s cradle-to-gate environmental performance. The increase should be interpreted as a modelling and database update effect, rather than evidence of a change in formulation, production efficiency, or factory operating conditions.

REVIEW AND VERIFICATION

Program Operator	International Climate Intelligence System 71-75 Shelton Street Covent Garden London, WC2H 9JQ United Kingdom
Registration Number	ICIS-202606-141
Publication Date	18-06-2026
Valid Until	17-06-2031
Geographical Scope	United Arab Emirates (UAE)
Product category rules (PCR): PCR 2026:18 Construction products (EN15804:2012+A2:2019/ AC:2021) Version 1.2.6 dated 21-Jan-2026	
PCR review was conducted by: International Climate Intelligence System	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 14040: EPD Process Certification (internal) ☑ EPD Verification (external)	
Third party verifier: Luis Manuel, International Climate Intelligence System	

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ACRONYMS

Acronym	Meaning
kg CO_2e	Kilograms of carbon-dioxide equivalent
kg CFC-11e	Kilograms of Chlorofluorocarbon-11 equivalent
mol H+e	Moles of hydrogen ion equivalent
kg PO_4^{3-} eq	Kilograms of phosphate equivalent
kg P eq	Kilograms of phosphorus equivalent
kg N eq	Kilograms of nitrogen equivalent
mol N eq	Moles of nitrogen equivalent
kg NMVOC eq	Kilograms of non-methane volatile organic compound equivalent
kg Sb eq	Kilograms of antimony equivalent
MJ	Megajoules
m^3 depr.	Cubic meters of water deprived
incidence	Unit representing human health impact related to particulate matter exposure
Kbq U-235 eq	Kilo-becquerels of Uranium-235 equivalent
CTUe	Comparative Toxic Unit for ecosystems
CTUh	Comparative Toxic Unit for humans
dimensionless	Unitless characterization factor — used for land-use/soil quality impacts
kg C	Kilograms of biogenic carbon contained in product or packaging

STANDARDS & REFERENCES

Standards & Methodological Frameworks

- EN 15804:2012 + A2:2019 / AC:2021 – Sustainability of construction works – Core rules for environmental product declarations of construction products.
- ISO 14025:2006 – Environmental labels and declarations – Type III environmental declarations – Principles and procedures.
- ISO 14040:2006 – Life cycle assessment – Principles and framework.
- ISO 14044:2006 – Life cycle assessment – Requirements and guidelines.

PCR & Program Documents

- PCR 2026:18 Construction Products, Version 1.2.6 – International Climate Intelligence System (EN 15804+A2 aligned).
- EPD General Program Instructions (GPI) of International Climate Intelligence System, v2.0, 2023.
- ICIS Environmental Product Declaration Template – International Climate Intelligence System, 2026.

Databases, Tools & Modelling Sources

- Ecoinvent v3.12, system model: Allocation, cut-off by classification.
- Ecoinvent Centre (2025). Documentation of Changes Implemented in the ecoinvent Database v3.12. Swiss Centre for Life Cycle Inventories, St. Gallen.
- Air.e.LCA Software v3.20.1.0 by Solid Forest – Used for LCA modelling and impact calculations.
- IPCC AR6 (2021) Characterization Factors – Applied for GWP indicators (where relevant).
- EF 3.1 (Environmental Footprint 3.1 method) – Used for all midpoint impact indicators.

Transport Calculation Tools

- Google Maps – Road transport distance calculations.
- PortDistance.com – Maritime transport distance calculations.

Biogenic Carbon Basis

- Intergovernmental Panel on Climate Change (2006). IPCC Guidelines for National Greenhouse Gas Inventories.
- Food and Agriculture Organization (2010). Global Forest Resources Assessment.
- European Commission Joint Research Centre (2010). ILCD Handbook – General Guide for Life Cycle Assessment.
- Confederation of European Paper Industries (2022). Paper Industry Sustainability Reports.

STANDARDS & REFERENCES

End-of-Life & Recycling

- Dubai Municipality (2022). Construction and Demolition Waste Management and Recycling Guidelines. Government of Dubai, UAE.
- Tadweer (Abu Dhabi Waste Management Center) (2023). Construction and Demolition Waste Recycling Operations. Abu Dhabi, UAE.
- BEEAH Group (2023). Waste Recycling and Resource Recovery Operations. Sharjah, UAE.
- Ministry of Climate Change and Environment (MOCCAE), UAE (2019). Guidelines for the Use of Recycled Aggregates in Infrastructure Projects.
- European Commission (2018). EU Construction and Demolition Waste Management Protocol. Brussels.
- National Wooden Pallet & Container Association (NWPCA) (2016). Pallet Recycling Study (conducted with Virginia Tech & USDA Forest Service).
- American Forest & Paper Association (AF&PA) (2023). Paper and Paperboard Recycling Statistics.

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