BRICK TECHNICAL BULLETIN

THE LOWIE HYBRID BRICK

PATENTED

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Inhoud

General Introduction

Although we are surrounded by millions of bricks every day, most of us don't think about bricks too often. For thousands of years, clay bricks have not changed and for a long time it seemed that they never would. However, everything changes and so do clay fired bricks. The fact is that the traditional energy-intensive furnacing process at high temperatures is simply not sustainable. Only a radical shift in the production method can preserve the classic brick we all appreciate.

Photo 1 Lowie Rustique White WF HV

Therefore, Lowie Bricks (LOW Impact on Environment) launched a research and development program in 2019 to find sustainable and affordable alternatives to classic facing bricks. By experimenting extensively with different materials, Lowie Bricks has managed to preserve the aesthetic and qualitative characteristics of ceramic bricks.

Lowie Bricks are Mineral based bricks consisting of selected range of sands, binders and water. The Vibro-Press production method with an additional finishing phase eliminates the necessity of high heat gas-ovens or heated curing rooms. The compressed matter consists of a semi-dry mixture that requires almost no water. By compacting while vibrating the mixture, air is pushed out so that the minerals and binder are forced to interact and assure for strong and optimal bonds. Curing of the bricks is fast and needs no additional heating due to the exothermic process. A finishing layer is applied to the bricks to give them their authentic look.

“We believe that real ecological progress is only possible if it is also affordable”

Photo 2 Lowie Design White Grey HV HF

Lowie Bricks counters the perception that sustainability costs money. We believe that real ecological progress is only possible if it is also affordable.

This is not yet an end point, we are constantly looking for solutions to further reduce environmental impact, with the ultimate goal of zero impact.

Technical Performance

The following Brick Technical Bulletin contains a broad explanation on different technical parameters. Each of the specifications are explained to ensure full comprehension of the performance of this new hybrid form of facing bricks.

European Standards

The Lowie Hybrid Brick offers an alternative to conventional clay bricks. Although aiming for the similar characteristics, the fact that neither clay and baking processes are used makes the Lowie brick not comply for clay masonry standardization. On the other hand, the binding process of Lowie Bricks is based on a hydration reaction similar to concrete binding. Although Lowie has a similar binding process, these new type of bricks differ on multiple aspects with concrete masonry units.

Not being Clay bricks and not being Concrete bricks, the Lowie positions as a hybrid brick. Lowie's Hybrid CE-certification and the DoP (Declaration of Performance) will not be applied to one single type of bricks but instead use both ceramic and concrete standards from the EN 771: Specification for Masonry Units. More specifically:

EN 771-1: Part 1: Clay masonry units [1]

EN 771-3: Part 3: Aggregate concrete masonry units (Dense and light weight aggregates)[2]

Note that the above mentioned standards are production standards only. Further suggestions regarding the use of these products can be found in Eurocode 6.

1. Compressive Strength

Lowie bricks have a minimum compressive average strength of 10N/mm^2, increasing over time towards 20N/mm^2. Lowie Bricks will, just like concrete bricks, gain strength during their lifetime. A Lowie brick generally crosses the 10N/mm² strength at an age of 3 Days and continues gaining strength towards 20N/mm² over its first month.

Due to the choice of reduction of binder content the strength of the Lowie Brick is relatively less high than clay or concrete alternatives. But as a result on the other hand, the reduction on climate impact are immense.

Clay bricks vary in strength, depending on type, with a typical strength range of 15-90N/mm2. There is no strength gain with clay.

For non-load-bearing external masonry, the minimal required compressive strength is 2N/mm². [3] This means, a Lowie brick exceeds this minimal value by over 5 times.

Did you know?

10 N/mm² strength over the bedding face op 80mm x 210mm results in a resistance of 16800kg per brick.

For Lowie bricks weighing about 1.4kg this is a wall of 12.000 bricks or 600m high

2. Dimensions

Lowie bricks aims on a reduction of CO2. Replacing the baking process of the bricks with a Mix and Compression production process allows for large CO2 reductions. But to avoid even more unnecessary emissions, Lowie bricks chose to produce the classic formats in a more Eco Brick style. Where Eco Bricks are 70mm, our Lowie bricks have a width of 80mm. Therefore being in-between conventional 100mm and the rather small 70mm Eco Bricks.

Following table shows the actual formats:

WF	Waal Format	210x50x80
HF	Hilversums Format	240x40x80

All bricks have the authentic Handmade (Handvorm) surface. All WF Lowie Bricks are available in the tumbled version.

3. Durability

Frost resistance durability tests have been conducted by an independent BELAC-Accredited Lab. Tests involve the construction of a small wall setup that undergoes and withstands 100 Freeze-Thaw cycles. Therefore landing on an F2 frost resistance.

4. Composition

Aggregates:

Sourced locally reducing transportation emissions. Mining of the natural minerals is with attention to Biodiversity. Habitat creation and Closure planning help retain the ecosystems during and after quarry exploitation.

Binder

Due to the carbonation process in the Lowie Brick, 58% of the binders CO2 emissions get recaptured in the bricks mass during its lifetime. [4] Carbonation is a process that allows weaker Hydroxides to bind with CO2 with as a result the formation of strong Carbonates. This process happens over lifetime and is influenced by CO2 content in the air, wind and diffusivity of air in the bricks.[5]

This phenomenon doesn't only lower the total emissions during lifetime but has other advantages such as its capacity to "self-heal" cracks. Carbonation only takes place when CO2 is in contact with the mass of the structure. When a microcracking would appear, the air (containing CO2) can easily enter the cracks and can make new bridges to strengthen the structure at the location of the opening.

We estimate that, due to capacity of the Lowie brick to transport vapor and water and the non-coated backsides of the brick, air can more quickly diffuse in the brick wall and speed up the carbonation process up to 3 times the conventional speed. This means that the CO2 released during production gets recaptured within 3 times less time than conventional bricks. The conventional carbonatation speed is 1mm up to several millimeters each year. This means that Lowie bricks carbonate up to 3mm each year. Resulting in a maximal carbonated mass already in 27 Years. Well within a clients own life span.

Comparison Table

Lowie Hybrid Bricks	Concrete Bricks	Clay bricks
European Standards		
CE 2+ referring to: EN 771-1: Part 1: Clay masonry units [1] EN 771-3: Part 3: Aggregate concrete masonry units (Dense and light weight aggregates)[2]	EN 771-3: Part 3: Aggregate concrete masonry units (Dense and light weight aggregates)[2]	EN 771-1: Part 1: Clay masonry units
Compressive Strength		
≥ 10 N/mm² - 20N/mm²	≥ 2 N/mm² - 40N/mm²	≥ 10 N/mm² - 90N/mm²
Dimensions		
WF Waal Format 210x50x80 HF Hilversums Format 240x40x80 EF English Format 215x65x100	Various types	Various types
Dimensional Stability		
Very consistent	Very consistent	Moderate due to shrinkage on firing
Water Absorption		
Total waterabsorbtion: <14% Initial Waterabsorbtion (IW): IW3	Total waterabsorbtion : 5-9% Initial Waterabsorbtion (IW): IW1 – IW 2	HF Total waterabsorbtion : <17% HF Initial Waterabsorbtion (IW): -> IW 3 SP Total waterabsorbtion : <6% SP Initial Waterabsorbtion (IW): -> IW 2
Composition		
Natural Minerals and a collection of binders	Produced from naturally occurring aggregates, Portland cement, various admixtures and supplements	Produced from naturally dug materials, frequently blended with other materials. Mostly Clay and Sand

Durability		
F2 → Fully frost resistant for 100 Cycles Soluble salts → Minimal	Frost resistant = Fully frost resistant 10 Cycles Soluble salts → Minimal	F2 → Fully frost resistant for 100 Cycles Soluble salts → May contain metallic salts such as sodium, potassium and magnesium, and consequently are categorised as either SO (no requirement), S1 or S2.
Green Credentials		
• Low binder content (minimal CaO) • No additional heat required during curing • Minimal water for manufacturing • CO2 emissions are minimal • Bricks are recyclable • Recarbonation during Lifetime • Water transport of raw aggregates • Embodied CO2 is low at 8KgCO2/m²	• No Firing • Additional heat used during curing • Recyclable • Recarbonation	• Bricks are dried out prior to firing • Very high kiln temperatures are energy intensive • Large amounts of CO2 ring firing process • Frequent imports to subsidise stocks • Bricks types tend to be unique to specific factories • Embodied CO2 is high at 44KgCO2/m²
Additional notes		
• Eco Friendly • Less energy in Production • Traditional aesthetics • Easy-to-use softness (cutting and laying) • High absorption for mortar ease-of-use	• Very high resistance possible • Heavy • Low water absorption for mortar ease-of-use	• Traditional aesthetics • High absorption for mortar ease-of-use •

Please note:

The above table provides a general overview. Variations can occur based on specific manufacturing processes and compositions.

Different manufacturers may produce concrete or clay bricks with varying specifications.

Environmental Performance Study

The Lowie brick is a hydraulic bond brick compacted by mixing, pressing and vibrating. This hydraulic reaction occurs naturally and is exothermic. This means we can avoid an energy intense baking process.

Carbon Footprint of Lowie Bricks

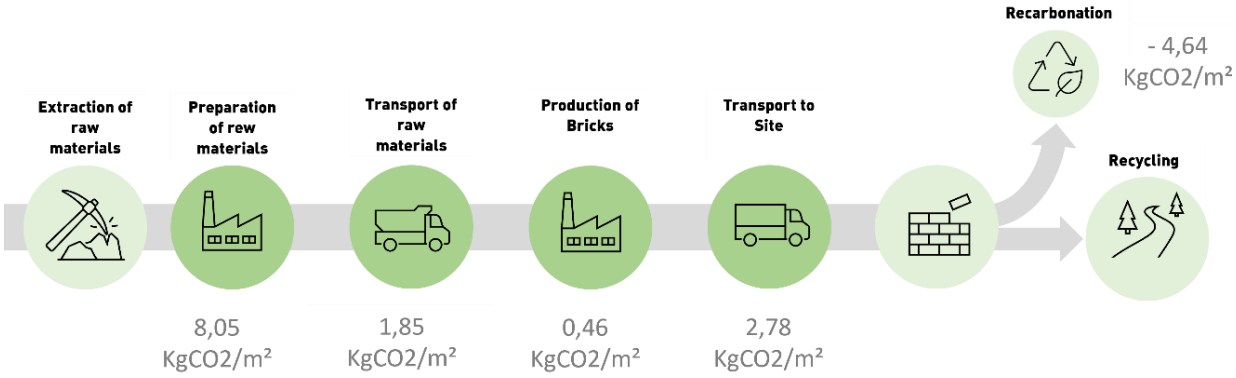
The Embodied CO2 of a Lowie Brick at the end of production is estimated as 10,36 KgCO2/m². This is assumed to be an "ex works" figure which takes into account the manufacture of the product itself, but not the transportation to the building site. [ENCON]

By comparison clay bricks have an embodied carbon content of 44,7kgCO2/m² from quarry to site. [6]

Looking at the full lifetime, a Lowie brick will absorb over half of the emitted CO2 during the Binder production therefore reducing the CO2 Emissions to 8,47 KgCO2/m². This is a reduction of 80% of the CO2 Emissions compared to conventional clay bricks.

Lowie Bricks emissions can be split up in four significant stages. First is the Extraction and refining of the raw materials. Followed by transport from quarry to site, the third process is production of bricks at our facility. Latest is the transportation to the Building site and its functional lifetime during which natural carbonatation takes place.

Extraction and preprocessing of materials are the initial and most crucial to the production of the bricks. Taking in account that during the functional life 58% of these emissions get recaptured. [4] Further, the transportation of raw and finished materials are the second most significant roles in emissions of the Lowie brick production process. The middle step being the actual production from aggregates to bricks is a relatively low energy intensive process. Running fully on green energy produced by bio-digesters, solar and wind energy of our local energy supplier Trevion.



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