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FROM IMITATION TO ACCEPTANCE TO WORLDWIDE PRODUCTION OF SCHOKBETON

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ABSTRACT.

The Dutch precast concrete company Schokbeton started activities in the early 1930's, introducing well compacted concrete elements some of them plain, others mimicking the colour, details, and surface finishes of natural stone. Being a modern, industrially produced material with a traditional stone imitating look, Schokbeton served both traditional and modern architecture. This paper presents original research on the factories' concrete recipes and products (1930–1970) and concludes on the development of the material from an imitation to a 'real' material in its own right. The paper discusses the relation between the patented production technology, the architectural products used in Modernist buildings and the concrete technology (recipes). The recipes show experiments with crushed stone and many different sands. At first, the mixtures seemed to be random, but looking closer it becomes evident that the post-war architectural developments highly relate to the use of certain aggregates in the concrete and therefore with the aesthetics. It is argued that the relation of the concrete mixture and production technology with the design of the concrete element has often been underestimated. It is clear that by the end of the nineteen fifties an International Style in precast-concrete was born. Schokbeton clearly played a role in this development, but based on recently discovered archive material it is questionable how big this influence has been.

1. INTRODUCTION

In 2015, the Dutch part of the international precast concrete company Loveld went bankrupt. This company was the legal continuation of the Dutch company Schokbeton N. V. founded in 1932. This brought compacting concrete by means of the patented shocking technology after 83 years to an end in The Netherlands. Researchers of TU Delft were enabled to save documents, including historic concrete recipes, from the laboratory. Together with approx. 300 sample castings, these archival materials laid the basis for new research into the production of Schokbeton.

Several studies have been published by e.g. Van Zuijlen, Stenvert, De Jonge, Pyburn, Heinemann, and Quist.[1] Either focussing on a single case, the production technology or the development of the company, all studies and consequent publications address the historical-technological importance of the brand and associated technology of Schokbeton. As the patented shocking technology was licenced all over the world, Schokbeton seems — in retrospect — to have reached almost mythical status.

This paper aims at understanding the role of Schokbeton in the development of architectural precast concrete in The Netherlands and its international exposure in the period 1930–1970 Two essential aspects of the concrete will be dealt with: the use of aggregates to reach different colours and surface structures and the frame or window frame as an architectural component that played an important role in the production of Schokbeton. From this perspective, the paper discusses the international influence of the company and its patented technology.

2. SCHOKBETON

2.1. Technology

The Schokbeton technology was based on optimal compaction of precast reinforced concrete with a low water-cement factor by means of lifting and dropping the mould on a stiff base with a very high frequency (up to 400/minute) over a height of 0.8–2.5cm.[2] The patent only regards the shocking technology and doesn't refer directly to the concrete mixture. To achieve the high grades of compaction, very well graded aggregates, mainly sharp crushed stone instead of rounded river gravel are necessary, especially with regards to finely detailed elements. Drawings, recovered from the company archive, illustrate that the development of equipment was an in-house activity. The *schoktafels* (shocking tables) for the Kampen factory (opened 1947), were designed, engineered and built by company staff. Also, drawings regarding factories in Puerto Rico and Accra have been identified in the archive.[3]

2.2. Products

From the patent, it becomes clear that Schokbeton started as a concrete compacting technology, not as a product. Although only referred to as an example, the drawing in the patent shows the production of a foundation pile. This seems to have been one of the first products resulting from the compacting technology. Together with other components related to groundwork such as sheet piles and planks those were advertised mind nineteen thirties under the name *of Schokindustrie*.[4] The overview of executed projects over the year 1938 shows a wide range of Schokbeton-components in buildings: industrial window frames, façade elements, structural components, small elements, etc.[5] The

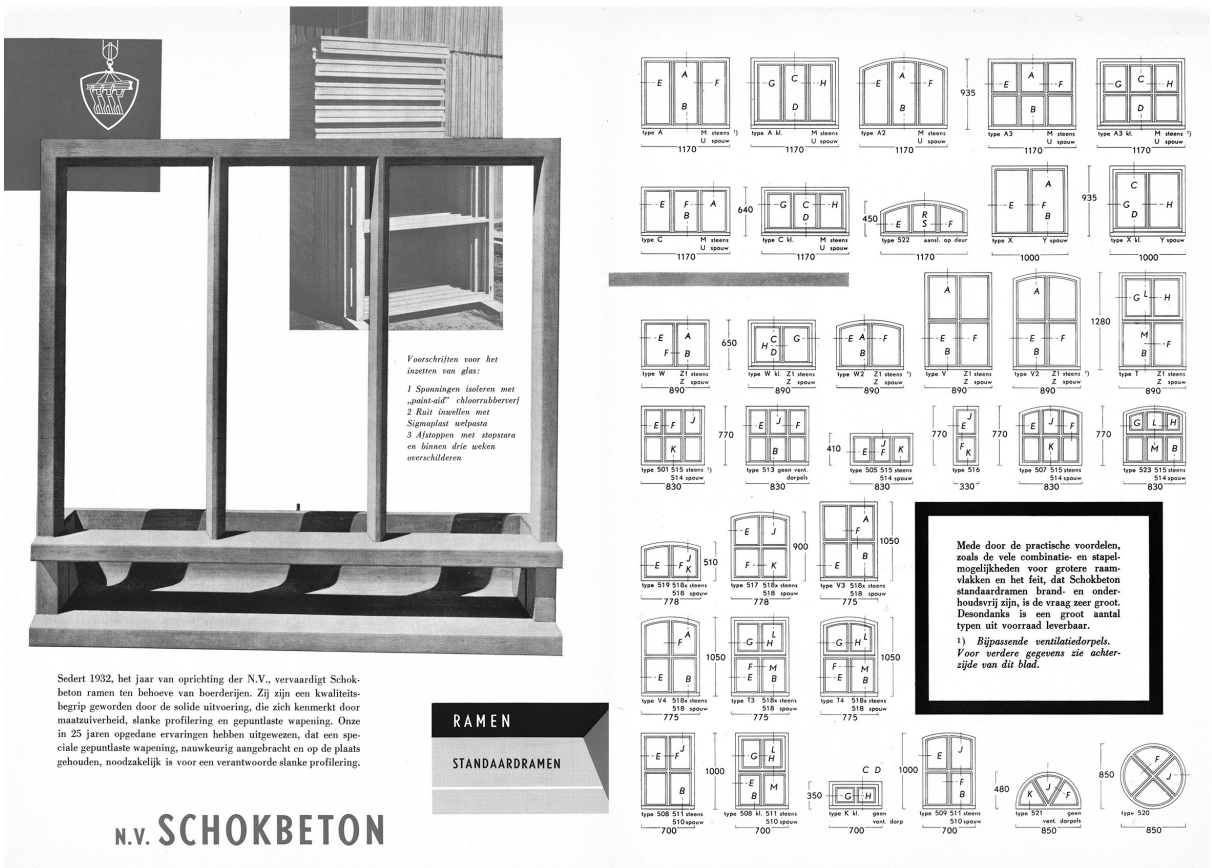


Fig. 1. **Two pages from a Schokbeton brochure on standard window frames (approx. 1960). © Schokbeton Collection Heritage & Architecture.**

term "Shockcrete" was used to brand components as artificial stone: e.g. *granite*, *syenite*, *sandstone*, *basalt* or *black Swedish*, referring to the (main) aggregate used.[6] Shockcrete refers to the aesthetic outer layer of the precast concrete. In their advertisements, Schokbeton argues that it is not an added layer (like a render) but cast consecutively and interconnected with the inner body of the concrete during shocking (and therefor more durable).

3. WINDOW FRAMES

The company Schokbeton mentions window frames in several brochures, annual reports and advertisements as an important product category, both referring to the standard window frames and the special products, designed and engineered for a specific project. The design, engineering, and consequent production of ventilating stable windows for animal farms in the newly created *Wieringermeerpolder* in the period 1935–1938 established a strong commercial basis for Schokbeton. A brochure dating approx. 1960 shows standard windows in many variants, angular, arched or circular in different sizes (**Fig. 1**). Many Dutch buildings are known with those off-the-shelve windows, ranging from farms to industrial building to churches. In retrospect it can be concluded that the window frame or any other façade element based on jambs, girders and fillings was the perfect product to be produced by the Schokbeton technology. The factory context allowed for an optimal alignment of the reinforcement and the shocking technology allowed for both a dense, hardly penetrable (by water and oxygen) surface and slender dimensions. Combined with a carefully designed concrete mixture with finishes exposing the coarse aggregates different aesthetics could be achieved.

A lot of successful and often referenced Dutch Schokbeton projects relate to the frame or window frame as the essential element. Even the barns built in the Flevopolder and the barracks for the US army built in Iceland and Greenland are essentially based on the principle of the frame: horizontal and vertical ribs with a thin slab in between shaped slender elements, creating a non-load-bearing wall.[7] It was only in the early 1960s that the production of precast concrete elements for two international projects — Banque Lambert by SOM (G. Bunshaft) in Brussels and the American Embassy in Dublin by John M. Johansen — seemed to have broken

Fig. 2. **Left: B. van Veen, Bank and apartment building, Rotterdam, 1939–1940, basalt-Shockcrete. Right: S. van Ravensteyn, Blijdorp Zoo, Rotterdam 1939-1941, brick-Shockcrete. © Wido Quist, 2020, 2019.**

with the tradition of the frame-based façade elements. Both projects have a heavy loadbearing exoskeleton instead of slender frame-based infills. The concrete elements were still produced with the 1930s shocking technology but it is questionable whether the compacting technology made the difference in those elements.

4. ARCHITECTURAL PRECAST CONCRETE

Although non-fired, mostly non-reinforced artificial stone is already known from the mid-nineteenth century (i.e. Ransome stone was patented in the United Kingdom in 1844), it took until the 1930s that precast architectural concrete came to the Dutch market at a large scale.[8] Experiments with concrete mixtures, stone imitating renders, finishing techniques, the production of structural precast concrete and the acceptance of concrete as a building material instead of only an engineering material paved the way for architectural precast concrete.[9] During the yearly fair for building materials in 1937 in Utrecht, several companies presented precast concrete with different surface finishes, amongst them Schokbeton. From 1938 the first advertisements by Schokbeton — introducing 8 types of Shockcrete — targeted at architects are known.[10]

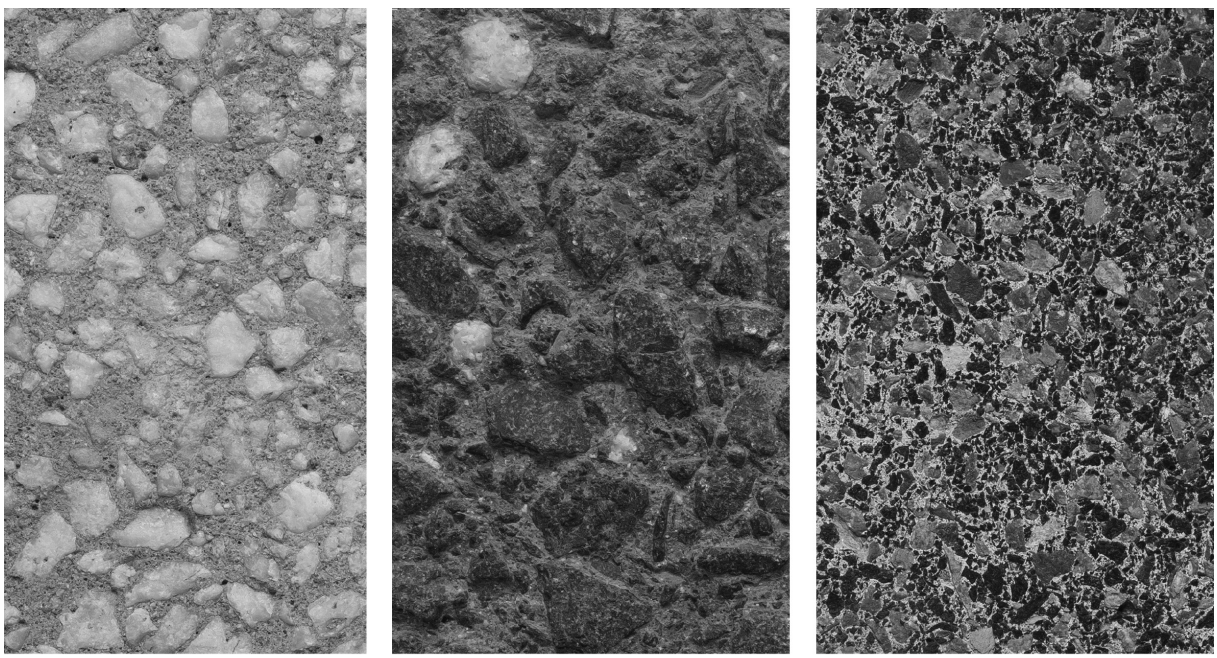
4.1. Shockcrete

Wattjes (1938) refers to Schokbeton with fine granite gravel used in the new Gymnasium of Leyden (architect J. Neisingh), without using the name Shockcrete. The first major use of Shockcrete, referred to as artificial granite or just artificial stone, seems to be the façade of Joseph Emberton's casino at Pleasure Beach, Blackpool, (1937–1939). The type of Shockcrete used at the casino was nr. 7 — *witte steenslag* (white crushed stone), at the Gymnasium either nr. 1 — *Saksisch graniet* (Saxon granite) or nr 5. —*Beiersch graniet* (Bavarian granite). In the case of Emberton's casino, it is mentioned that Medusa cement was used.[11] Medusa was an American Portland cement producing company, both ordinary grey and white PC.[12] When referred to it in the Dutch context it may be assumed that it is referred to as white Portland cement, because ordinary grey Portland cement was also available from many other (European) suppliers. This complies with remarks on recipe lists mentioning that all recipes contain ordinary grey Portland cement, unless otherwise noticed.

Shockcrete nr. 4 — *Basalt grijs* (grey basalt) was used in 1939–1940 in the façade of a former bank and apartment building (Goudsesingel, Rotterdam, architect B. van Veen; **Fig. 2**). In the same period, Blijdorp Zoo was designed by architect S. van Ravensteyn, using different elements of Schokbeton. At the *Rivièrahal* (**Fig. 2**), the main building of the Zoo, Shockcrete nr. 18 — *paarse klinker* (purple brick) and nr. 19 — *gele klinker* (yellow brick) have been macroscopically identified.

The list of Shockcrete types expanded from the 8 known in 1938 to 52 in an undated list, presumably dating to the end of the nineteen fifties.

Although the company Schokbeton continues to use different aggregates for architectural concrete, the use of the term Shockcrete seems to not always have been used by the end of the nineteen fifties. With the Neherlab in Leidschendam (S. J. van Embden, 1955) it is used, but not in the context of three telephone exchanges in Amsterdam (municipal architects, 1959–1960).[13] With the Banque Lambert in Brussels



1 818

Grijs portland cement

58% Eifelwit *8-12 mm*

32% Witterschlick *0,1-1 mm*

10% Eifelwit *3-5 mm*

6 593 ST

Grijs portland cement

+ zwarte kleurstof

48% Basalt *8-12 mm*

28% Zand *0-2 mm*

21% Basalt *1-8 mm*

3% Eifelwit *8-12 mm*

K 2618 BWS

Wit cement

33% E split *2-5 mm*

33% Diabas *0-1 mm*

20% Beiers groen *2-6 mm*

14% Diabas *2-5 mm*

Fig. 3. **Three sample pages from the Schokbeton reference fan. © Wido Quist and Jaqcueline van Dam, 2019.**

(1963), the term is back in use.[14] There could be a relation between the application of an outer layer of aesthetical concrete and the term Shockcrete, although "shockcrete" is not mentioned. In the case of the Osdorp telephone exchange there is a minimum thickness of the outer aesthetical layer of the precast elements mentioned of 30mm.[15] The term Shockcrete is not mentioned in the 1971 licensee manual.

4.2. Development of Recipes

About 1000 different recipes in all its variants have been identified in the recipe-books from Schokbeton's concrete laboratory. All the available information has been entered in a database for easy reference (**Fig. 3**). Due to the different ways of describing, numbering, listing and to the absence of dating information, it is — with this information — not yet possible to completely reconstruct the development of recipes, but some tendencies can be observed. Further research on the synonyms of different aggregates, the in-depth analysis of the technical information and the combination with other archival sources will eventually reveal even more information.

4.2.1. BLACK OR DARK GREEN CONCRETE

Among the first eight recipes, three of them are blackish-greenish: syenite, basalt and black Swedish, obviously referring to stones that were very popular during the 1920s and 1930s in The Netherlands, especially in the Amsterdam School — and related — architecture. The recipes with dark aggregates show a large variety in cement type and/or add mixtures. Using grey Portland cement in combination with black basalt — depending the grading of the aggregates — would result in a greyish concrete, where white Portland cement together with basalt would make the aggregate stand out more. The use of manganese black as a pigment together with grey Portland cement gave a darker cement paste.

4.2.2. WHITE CONCRETE

Next to the dark blackish-greenish coloured Schokbeton, light-coloured concrete elements seem to have been very popular, according to the number of recipes. The façade elements for Emberton's casino were probably the first ones

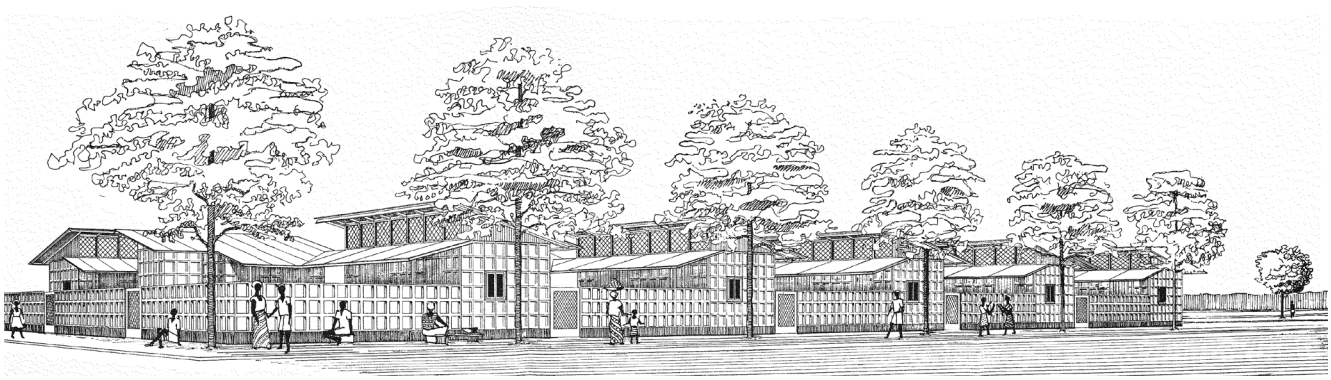


Fig. 4. **One of the designs for housing in Accra by N. V. Raatbouw / N. V. Schokbeton. © N. V. Raatbouw 1952.**

as the elements for the Banque Lambert in Brussels probably represent the ultimate whiteness. The use of white Portland cement — in later recipes accompanied by the pigment titanium dioxide — combined with silver sand is the obvious basis to create a white concrete. Coarse aggregates that can be observed in the white recipes are mainly Eiffel quartz together with the more yellowish Taunus gravel or Kaiser gravel or a multicolour river gravel, but also Cararra marble, different types of white limestone and the industrially produced grenette, luxovit and granusil can be found in the database. The 1971 licensee manual advises to polish the white concrete to expose as much as possible the white aggregates that were less vulnerable to soiling then the cement paste.[16]

4.2.3. SPECIALITIES

Crushed brick seems to appear in recipes in the late 1930s and 1940s, just like shells and silex. The use of finely crushed brick as aggregate is known from Blijdorp Zoo and precast concrete elements of several railway stations by architect Schelling show crushed ceramics as well. Also, silex is identified in the façade elements of Schelling's railway station of Zutphen. Although Schokbeton casted elements for this station, it is not clear which elements, as it is also known that Meteoor — another precast concrete company — delivered elements for this building.[17]

5. DISCUSSION

The relation between the patented shocking technology, the wealth of recipes and the frame-based concrete elements has never been emphasized before. This perspective even strengthens the unique contribution of Schokbeton on Dutch Modernist architecture, but it directly questions the international importance. Although an exact chronological list of international companies using the patented shocking technology does not exist, it is clear that *Højgaard & Schultz* in Copenhagen from 1951 onwards was one of the first outside The Netherlands producing Schokbeton elements.[18] The resemblance between their first buildings and the Dutch frame-based façade architecture is remarkable. Not only the patent was exported, also the engineering. Whether this was successful on the longer term is not known.

In 1952 Raatbouw (a Schokbeton company) exported 134 housing units to Gold Coast and Dutch engineers and architects did an extensive research in the possibilities to start a Schokbeton factory in Accra with the aim to produce cheap houses, solving the local housing shortage.[19] They even studied and tested the possible sources of local fine and course aggregates. Knowing the experiments with social housing on the Dutch Schokbeton factory site in 1947–1949, it is clear, looking at **Fig. 4**, that Schokbeton tried not only to export the patent but also the product (façade elements).[20] In the end, the houses turned out to be too expensive, but it is also imaginable that the Dutch based architecture did not appeal to the Africans.

When the Schokbeton license finally came to the USA in 1960, the 1940s–1950s slender concrete architecture was coming to an end and the load-bearing façade was becoming popular. Of course, those elements could also be made by using the shocking technology, but it is questionable if this technology was a prerequisite. Further research on the portfolios of the different Schokbeton licensees should shed a light on the real influence of Schokbeton on the International Style looking at the patented technology, frame-based elements, concrete recipes, and their relation.

ACKNOWLEDGEMENTS

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NOTES

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