Van de Voorde, S., Bertels, I. & Wouters, I. 2014. *The emergence of a new generation of building products in post-war Belgium. The case of lightweight concrete*. In: James WM Campbell (e.a.), *Proceedings of the First Conference on the Construction History Society*. p. 423-433.

THE EMERGENCE OF A NEW GENERATION OF BUILDING PRODUCTS IN POST-WAR BELGIUM. The case of lightweight concrete.

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Introduction

According to a survey in 1969, only two per cent of the houses in Belgium were constructed using industrialized building techniques. This percentage is significantly lower than in other countries such as the UK, France, Germany and Eastern Europe, where 10 to 30 per cent of the houses were constructed with industrialized building methods.[i] The reason for this low percentage in Belgium is often sought in 'the habits, the everyday routine and the scepticism of the people towards everything that is new and hasn't proven its worth yet.'[ii] If we take a closer look at the Belgian building industry, in particular the house building sector, we can find underlying and related causes to account for this. As we will explain in the first part of this paper, one of the main reasons can be found in the general structure and organization of the Belgian building industry; in addition, also the government policy, the traditional Belgian housing typology and the interaction between public bodies, owners, architects and builders lead to the use of certain types of building products and methods. The second part of this paper will elaborate on how knowledge of the new or improved building materials and techniques was disseminated through architectural journals, being one of the most appropriate mediums to reach a wide audience. Finally, we will focus on one specific category of this new generation of building products, namely lightweight concrete. Starting from articles in the periodical press, we will elaborate on how, why, when and where lightweight concrete was developed, marketed and used in the Belgian house building sector.

A. Post-War building in Belgium: actors and organization

1) Organization of the building industry

In the post-War period, the Belgian building industry was characterized by a very large proportion of small and medium-sized companies: 85 per cent of building companies employed only one to four workers.[iii] Additionally, the sector was not very well provided with capital, hence the frequent reproaches of technical inertia, lack of specialized labor and low productivity. Indeed disorganized, yet not solely responsible for this, the sector had no perspective or incentive to invest in large-scale building techniques, equipment and training,

unless the public authorities set up large-scale building programmes. The vicious circle created by the industry's focus on small, traditional and 'safe' contracts on the one hand and the lack of large-scale projects supported by the government on the other hand, left little room for alternative building methods to fully develop. It is not until the 1960s that we see a first sign of professionalization, scientific application and technical upgrading of the sector. In 1960 the Belgian Building Research Institute was established by the Federation of Belgian building contractors. Ten years later a technical quality label for building products was introduced. .[iv] Yet during the 1970s, the first oil crisis weakened this positive trend.

2) Public commissioners and private owners

Immediately after WWII, a limited number of innovative initiatives and large-scale projects was set up by public bodies, yet for several reasons (technical, financial, aesthetic, etc.) none of them was continued beyond the experimental stage.[v] The authorities generally adopted an ad hoc policy, operating independently from each other, with little attention to the transfer of knowledge. Seeking to solve the housing problem in a swift and easy way (limiting the need for technical innovation and supervision by the government to the minimum), Alfred De Taeye, representative for the Catholic People's Party, submitted a law in 1948 stimulating private initiative.[vi] The famous/notorious 'Law De Taeye' offered grants to private individuals to build a modest family house. It was an immediate success: in only six years', 100,000 De Taeyegrants were awarded. However, the grant was indirectly detrimental to collective housing projects. The outcome of the law is also very apparent in the street scene, at least in the height and typology of buildings. If we look at the number of houses built between 1946 and 1981, only five per cent are apartment buildings, 23 per cent are terraced houses, 29 per cent are semi-detached houses and 42 per cent are detached houses. If we look at the number of floors, all categories are best represented in the two- or three-storey buildings (even the apartment buildings), except for the detached house (mainly bungalows with only one floor).[vii]

3) Improved traditional building methods

Although the De TaeyeLaw did not specify construction techniques or architectural styles, it (unintentionally) gave rise to conservatism. As it did not provide stimuli for a rational, efficient and economical building practice, owners and builders rarely abandoned the traditional idiom of the small house with red bricks, wooden window frames and a saddleback

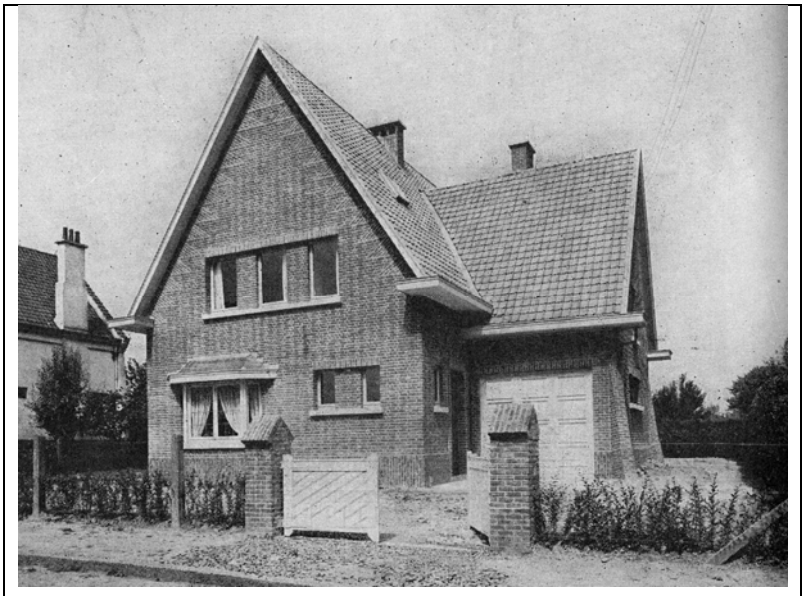

Fig. 1. A typical De Taeye-house with red bricks and ceramic roof tiles (P.-L. Flouquet, La petite maison familiale, Brussels: Art et Technique, 1950, p.60).

roof with ceramic roofing tiles (Fig. 1).[viii] Nevertheless, the building industry did not come to a standstill: even within the traditional idiom, there was room for improvement, with materials and products that could be integrated without complicated adjustments or details nor heavy equipment. Steering a middle course between innovation and tradition, 'le traditionnel évolué' or 'improved traditional building methods' made use of often common materials but with enhanced technical, economical or architectural characteristics. Examples of these improved traditional building materials are lightweight building blocks; hollow core slabs; new (finishing) materials such as rubber, vinyl or linoleum; prefabricated panels in different (composite) materials like cement, asbestos, wooden fibres and plastics; new types of glass and various materials for acoustic or thermal insulation. These materials and products did not imply high-tech developments or fundamental changes in the building process, yet it was necessary to develop the (practical and theoretical) scientific equipment: manufacturers needed to deliver full data on the characteristics of the materials, which in many cases were already developed during the first half of the twentieth century, but were only used on a large scale during the 1950s. In addition, commercial strategies were needed to sell these materials and products to architects, commissioners and builders, for example through architectural magazines and journals.

B. New construction techniques and materials in the periodical press

Architectural and technical periodicals are an interesting and rich source of information for research in construction history.[ix] As a direct, heterogeneous and topical means of communication, the periodical press was a perfect medium to promote new building materials and techniques, either by means of articles on specific applications or by means of advertisements and supplements. For this study, we have selected three Belgian post-War

journals with a different profile and discourse, namely *La Maison*, *Architecture* and *Bouwen&Wonen*. A close-reading of these journals corroborates the typological importance of low-rise housing in Belgium, in which improved traditional building methods are used increasingly. We will focus on how these three journals report on the new building materials and techniques, to elaborate on specific characteristics and applications further on.

La Maison was the first and one of the longest running post-War architectural periodicals in Belgium. Published every month between March 1945 and February 1970, it focused on the design, decoration and equipment of the (private) house, not only in Belgium but with a broad international perspective. Putting both modernism and traditionalism or regionalism on the agenda, it aimed to reach a wide audience. With a discourse that is rather informative and educational than polemic or progressive, *La Maison* is considered as one of the conservative architectural journals in Belgium, at least in comparison with for instance *Bouwen&Wonen* or *Architecture*. Maybe surprisingly, because not consistent with its (supposed) traditional image, *La Maison* gave relatively substantial information on new building materials and construction techniques. Even in the first volumes, reflecting the reconstruction and housing needs of that time, *La Maison* wrote about experiments in house building such as the international exposition on experimental temporary houses and the national building yards for alternative building methods. In general, the editorial voice took on a critical-positive tone towards these reconstruction experiments. From the 1950s onwards, we see a diversification of the articles on construction and techniques. Next to more general or reflective articles on broader themes such as industrialization, normalization and rationalization of the building industry, we can distinguish three main categories. A first series of articles deals with building services, mainly heating and ventilation, but also electricity, lighting, building acoustics, heat recovery and kitchen and bathroom equipment. Published with roughly the same frequency as the first topic, were articles on specific building systems for houses in different materials (e.g. houses in monolithic or lightweight concrete, a bungalow in aluminum, wooden houses or houses in plastics). Perhaps more representative of/relevant for the daily building practice are the articles reporting on building materials and products, with new types of glass and thermal or acoustic insulation as very popular topics, next to wood, cement, plastics, wooden frames, gas concrete (Fig. 2), fire-resistant boards, and asbestos.

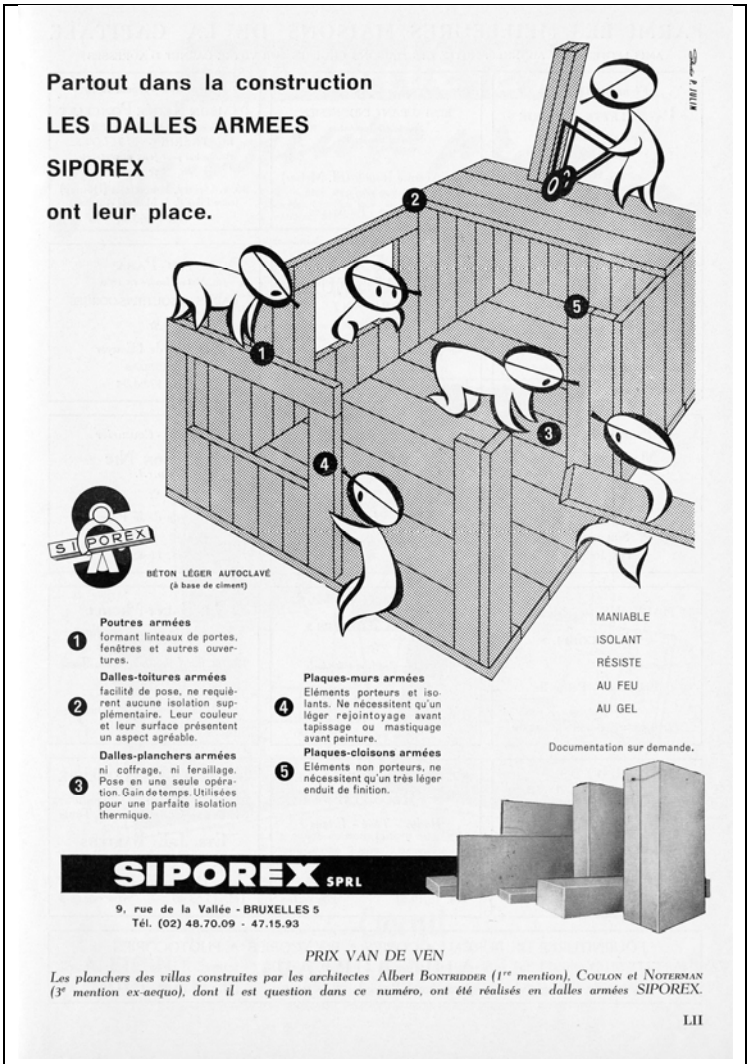

Fig. 2. A typical advertisement for gas concrete: lightweight, easy to handle and low thermal conductivity (La Maison, vol. 16, no.3, 1960).

The monthly periodical *Architecture* roughly covers the same period (January 1952 until April 1970), but holds a very different stance: founded by a very large group of progressive architects, the so-called new generation of modernists, *Architecture* reports almost exclusively on modernist architecture. Next to news items on current affairs, a few monographic studies or editorial pieces on architectural trends, almost all articles in *Architecture* dealt with recent completions, yet within this one type of article almost every architectural typology was covered, from small family houses, offices, churches and schools, to high-rise apartment buildings and industrial complexes, often brought together in thematic issues. Information on building materials and construction techniques was mainly confined to the technical information given in the description of completed buildings, supplemented with an occasional article on technical issues (e.g. heating systems, acoustics, industrialization of house building, prefabricated schools, vacuum concrete or the Preflex-beam) and a few thematic issues on technical topics and materials (prefabrication, prestressed concrete, wood, glass and heavy prefabrication). In all, technical information was mainly inserted in descriptions of practical applications, as an inherent part of the architecture, making *Architecture* (at least its table of contents) less technical than one would expect from the editorial board which included a few architects with a distinct technical interest such as Willy Van Der Meeren and Renaat Braem.

The latter, Renaat Braem, one of the key figures of post-War modern architecture in Belgium, was also founder and editor-in-chief of *Bouwen&Wonen*, a monthly periodical that ran from October 1953 until March 1962, with a distinct technical character. Not that it reported exclusively on construction techniques and materials: *Bouwen&Wonen* covered a broad range of topics, with regular features on, for example, interior architecture and urban planning as well as art, but these topics and articles were strongly related to the field of interest of the members of the editorial board. The technical thematic issues of *Bouwen&Wonen* dealt with wood (several times), concrete, bricks, new finishing materials and boards, insulation and the National Building Centre in Antwerp (several times). As in *La Maison*, among the technical articles we find more general pieces (building costs, industrialization, cheap housing) and articles on building services (heating, ventilation, lighting, electricity). Far more important in *Bouwen&Wonen* though are pieces on specific materials: many articles on wood (including complete building systems, new types of beams, calculation methods,…), steel and aluminum, cement and concrete, insulation materials, plastics and synthetic materials (e.g. polystyrene, paint and resins). Prominently present are new types of prefabricated boards and panels (e.g. Novopan, Ultrawood, Eternit, Formica, Triplex, Soundex, Mureclair,…) and products in lightweight concrete (gas concrete and wood fibre concrete such as

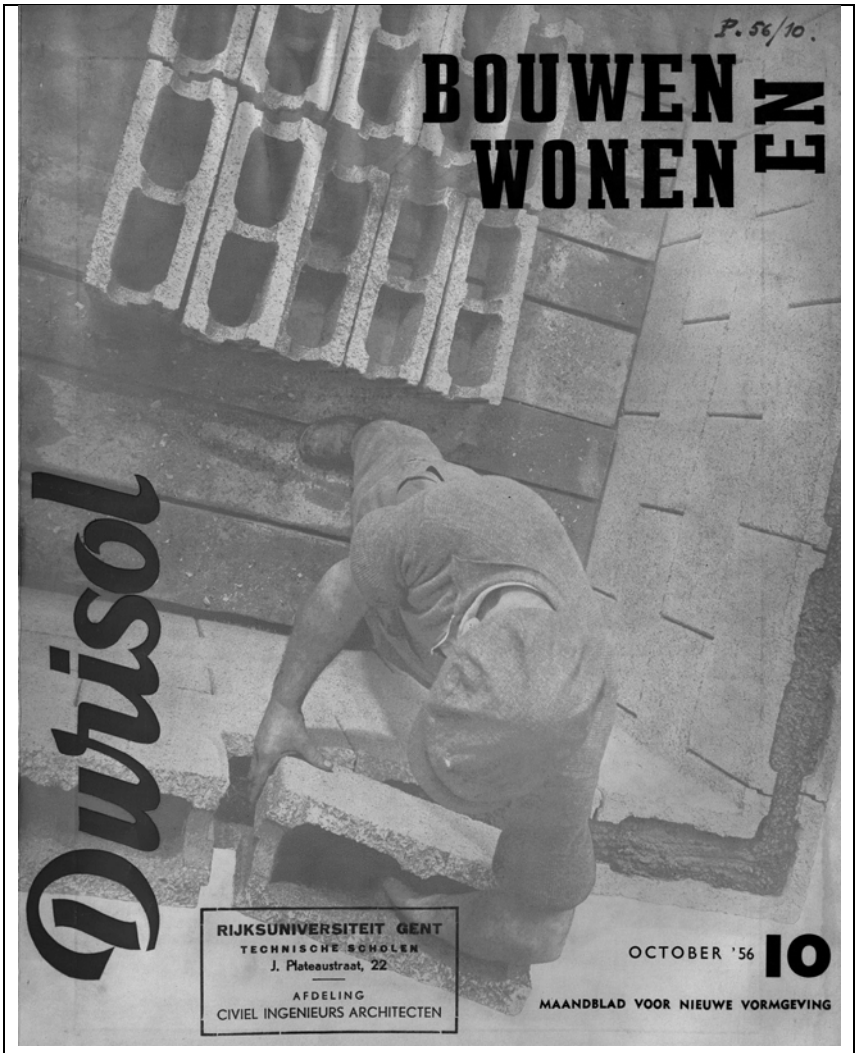

Fig. 3. Cover of the October issue of Bouwen&Wonen in 1956: an advertisement for Durisol-blocks.

Durisol, Ytong, Siporex and Durox) (Fig. 3). Often these articles on products and materials were related to an event in the National Building Centre, e.g. the erection of the Durox- and Eternit-pavilion or an exhibition on thermal and acoustic insulation. The centre was created in 1958 to provide information and advice on building and to lift the contemporary building practice to a higher level.[x] Although these objectives sound very estimable and altruistic, some doubts about the objectivity and independence exist. What applies to the articles and the advertisements in *Bouwen&Wonen*, also applies to the information and the pavilions at the National Building Center: all four often carry the same signatures, both from architects and building companies as well as manufacturers and material suppliers. Not only did the two main figures running the journal and the National Building Centre, namely architect Braem and contractor Victor Van Coillie, take on different roles simultaneously, the centre could also rely on the financial or material support of many companies who appeared in the advertisements and articles in *Bouwen&Wonen* quite regularly. This rather small but dense network of actors calls for prudence when interpreting the data.

C. The case of prefabricated elements in lightweight concrete

If we want to look at the facts and figures, commercial strategies and practical applications of one type of material, lightweight concrete is a very interesting case in point. *La Maison, Architecture* and *Bouwen&Wonen* each report on lightweight concrete in a very different way, expressing different degrees of approval and advocating different applications for the material.

Within the class of lightweight concrete, we can distinguish lightweight concrete made with wood fibres (e.g. Durisol) and lightweight concrete with a foaming agent, also called gas concrete (e.g. Ytong, Siporex and Durox).

Ytong is made of lime and silica, mixed with aluminum powder, provoking a chemical, foaming reaction. After the mixture has hardened and the concrete is sawn into pieces, it is put in autoclaves under steam pressure to finalize the chemical reaction and give the material its full strength. With only approx. one third of the specific gravity of concrete and very low heat conduction, the material was very popular in Sweden (where it was developed in 1929 and had become one of the most important post-War building materials) and Germany. In Belgium, the first Ytong-factory was erected in 1954-55. Even by 1955, in its thematic issue on concrete, *Bouwen&Wonen* predicted a swift development for Ytong in Belgium, as the material was well tested elsewhere and the benefits were numerous.[xi]

In the same category of gas concrete, Siporex was developed in Sweden in 1935 and was produced in Belgium from January 1956. In October that year, in a thematic issue on Ytong, Siporex and Durisol, *Bouwen&Wonen* listed the advantages of Siporex: solid, resistant to fire and moist, isothermal, easy and quick to handle with less equipment, modulated and enabling architectural diversity (Fig. 2).[xii] These advantages are not exclusive to Siporex and are valid for other lightweight concretes as well. In fact, Siporex is manufactured in the same way as Ytong, except for using cement instead of lime as its base material. One of the differences, albeit superficial, was the shape and size. The range of Ytong was mainly limited to blocks, while Siporex was delivered in different forms: elongated blocks (50cm long, 25cm high and 15 or 30cm thick), entire wall panels for insulation (from 7 to 15cm thick), reinforced floor or roof plates (up to 6m long, between 12.5 and 25cm thick to carry a maximal load of 400kg/m²), reinforced lintels, etc.

For typical applications of steam-cured lightweight concrete, Durox provides an interesting comparison. Durox was given a lot of attention in *Bouwen&Wonen*, especially with respect to the experimental Durox-house by Braem at the site of the National Building Centre (Fig. 4).[xiii]

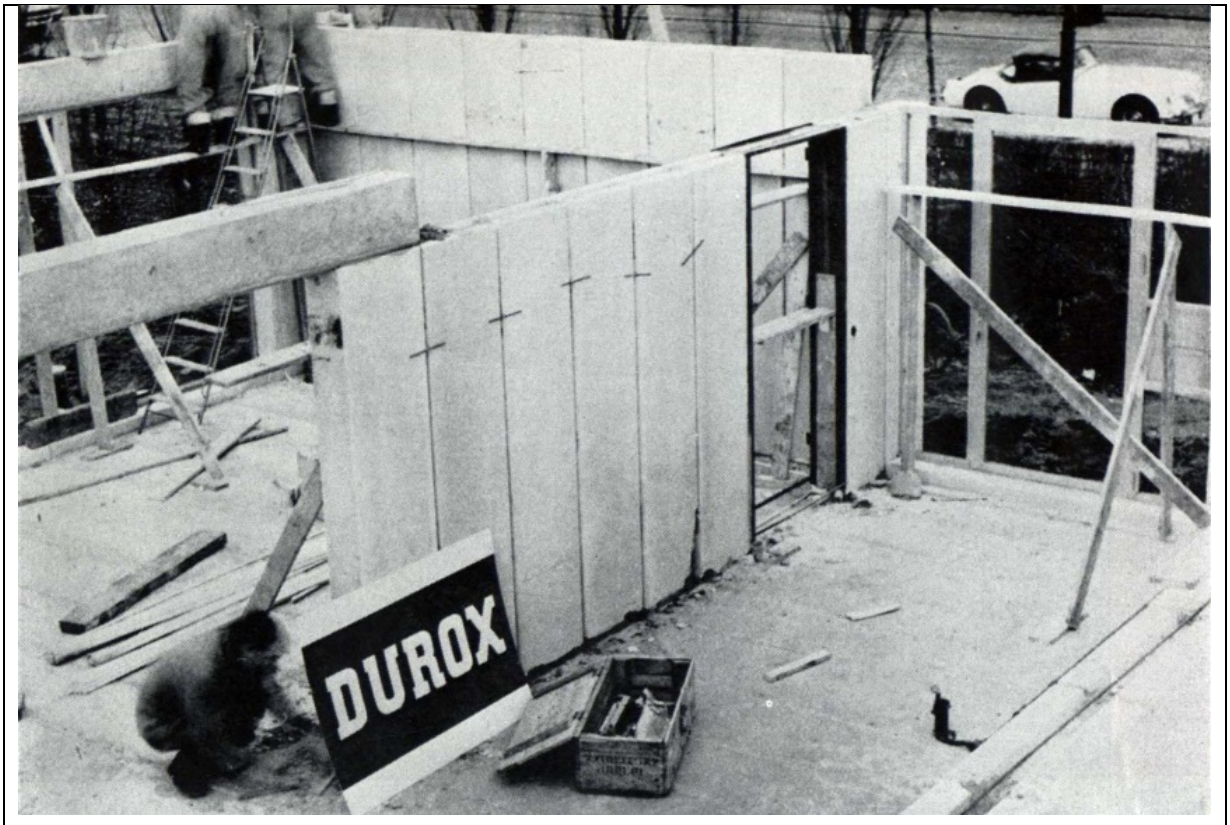

Fig. 4. The erection of the Durox-house at the National Building Centre took only 5 days (R. Braem, "Durox-huis type Braem", Bouwen&Wonen, vol.7, no.5, 1960, p.188).

The goal of the experiment was to show that it was possible to construct a house quickly and cheaply, with the use of prefabricated elements. Why Braem choose Durox for this experiment (and not another brand of gas concrete), is not clear: the literature rather lets us believe that the different brands were interchangeable. The Durox-pavilion was constructed in March 1960, in a record time of only five days (not counting the two days extra for electricity and finishing). It was a single-storey house, based on a module of 50cm, being the standard width of Durox-panels. The external walls were 21cm thick, and 11 or 15cm for the inner walls and 15cm for the roof plates. The joints between the Durox panels were flushed, after which the external walls were painted. While Braem did not succeed in executing this prototype on a larger scale, architects Constant and Godart did manage to construct a social housing project in Seraing with 60 houses, with inner and outer walls made with standard Durox-panels of 2.50m by 0.50m (Fig. 5).[xiv]

Fig. 5. An advertisement of Durox, depicting the housing project in Seraing (Architecture, no.52, 1963).

Next to these examples, in which the manufacturer was closely involved from the outset, there is also another type of application. In a country with an individualistic architectural tradition, the external appearance was no less important than the technical advantages. Accused of being dull and too prone to damage because of its softness, different options for its external treatment were elaborated, from simple painting over plaster to a complete wall in bricks.[xv] Although it was perhaps not completely in accordance with the philosophy of the material's inventors, the option with an outer brick wall seemed to be the most popular. For example this was used for the 289 single family houses of the housing project Ban Eik in Wezembeek-Oppem by the architects of Groupe Structures: the inner walls in Ytong are covered with external walls in traditional bricks (Fig. 6).[xvi]

Fig. 6. Aerial view of the Ytong- and brick-houses in Wezembeek-Oppem (Private collection, Van Coillie).

In the second category of lightweight concrete, namely concrete with wood fibres, there is only one main popular brand, namely Durisol. Developed in Switzerland during the 1930s, Durisol was manufactured by mixing cement and water with mineralized scraps of wood

which were resistant to moisture and chemicals.[xvii] Durisol is not just a different material from gas concrete (yet with similar characteristics such as a low specific gravity, easy to handle and easily adjustable at the construction site by sawing), but is also used in different ways: either as panels, planks and slabs (similar to gas concrete panels) or, the more popular way, as hollow blocks and slabs to become a permanent mould for loadbearing walls and floors in reinforced concrete (for buildings up to 15 floors) (Fig. 3). The Durisol-blocks were used in numerous projects (e.g. the large-scale housing projects 'Kiel' in Antwerp by Braem, or 'Plaine de Droixhe' in Liège by EGAU, but also in a large number of small-scale constructions), yet as they are plastered or clad afterwards, they are hardly ever visible.

The way the architectural journals report on the various kinds of lightweight concrete is very different, but this is more related to the journal than to the manufacturer. The manufacturers came up with many initiatives and events to convince potential clients, directly or indirectly through the journals as a communication medium, for example by inviting the editorial board to the factory, organizing technical meetings, cooperation on practical projects, organizing an abstract design competition amongst architects to get them acquainted with the material,…[xviii] The way journals reacted to these initiatives is of course very different: *La Maison* and *Architecture* for example were rather 'economical' with technical information, while *Bouwen&Wonen* was not afraid to give specific data on material characteristics and physical properties. Incidentally, in many cases the information is incomplete and not always sufficient to set up an appropriate and respectful renovation strategy for those post-War houses in urgent need of renovation.[xix]

Summing up how these new or 'improved traditional' building materials have influenced post-War design and building practice in Belgium, one of the findings is that the use of these materials has hardly ever had heavy implications for the architectural design. As for lightweight concrete products, they were mainly used because of economical and pragmatic advantages (lighter, quicker, cheaper), yet still within a relatively traditional concept: the properties which are attributed to the materials (prefabricated, rationalized, innovative) are not, or not necessarily, transmitted to the buildings in which they are applied. Although a few architects made an honourable effort, the use of lightweight concrete did not (successfully) lead to an inherent architectural aesthetic or idiom: the building practice might have changed, yet the architectural design practice was relatively unaltered.

Acknowledgements

This paper fits within the framework of a research project (2013-2015) on post-War housing in Brussels, funded by the Brussels Capital Region through the Innoviris Strategic Platform Environment 2012 'Brussels Retrofit XL'. See also www.brusselsretrofitxl.be.

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[iv] S. Van de Voorde, Bouwen in beton in België (1892-1975), Ghent University (PhD), 2011, pp.469-471.
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[xiii] R. Braem, "Durox-huis type Braem", Bouwen&Wonen, vol.7, no.5, 1960, pp.183-186.
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