House on a Bunker by Architect R. Romke de Vries: From Military Accommodation to Residential Refinement

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Abstract. The construction of houses on bunkers is not uncommon in post-war Holland, yet this project in The Hague, conceived by architect R. Romke de Vries between 1951 and 1955, sticks out as a pioneering design. A large concrete bunker was reused as an artificial rock foundation for the construction of a new house that was commissioned by contractor Jan van Kampen. In close collaboration with his client, Romke de Vries managed to create a remarkable synergy between both old and new constructions, interior design and garden layout, bringing together many of his previously published innovative design strategies for the post-war home interior. All fittings and furnishings were profoundly detailed and painted in a remarkable colour scheme. This essay is dealing with innovative residential issues by architect Romke de Vries with special attention to technical approaches, the colour scheme and the interaction between architect and client/contractor. This study also addresses objectives of basic comfort standards, improvement of the energetic performances, efficient approach of the damage phenomena and issues of building physics.

Keywords: Post-war heritage · Energetic performance and heritage Reuse · War relics · Paint research

1 Introduction

1.1 Architect R. Romke de Vries (1908–1997)

The Dutch architect and publicist Romke de Vries graduated during World War II at the *Hooger Bouwkunst Onderricht* in Amsterdam. His extensive oeuvre is evidenced by numerous reconstruction projects designed from a social and community-based commitment [1]. His post-war modernism was influenced by the *Nieuwe Bouwen* style, but he was also attentive to tradition and craftsmanship in line with the *Delft School* approach. During an interview in 1969 by the *Ideaal Wonen* magazine, he summarises his vision on architecture as follows: *'Today architecture is not an isolated initiative.*

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It is part of an all-round planning and design, starting with crafts and industrial design over vehicles, ships, interiors, dwellings, to end up with the layout of entire cities and districts. The focus in this approach largely lies on the objective, the attitude, and the manner in which the issue is dealt with. Design serves to visualize and express society, which in itself is not an end, but a means to the highest possible development of man as an individual. It is a crucial factor, which contributes to people's education. Only then design can be an added value for our overpopulated continent of Europe' [2].

1.2 Traces of the *Atlantic Wall* in the Hague

The bunker line in the residential district of *Benoordenhout* in The Hague is part of the *Atlantic Wall* built by the German occupier during World War II. After liberation, the elimination of all former defence works was a high priority from a practical perspective but even more to forget the unpleasant reminiscences of war [3]. Sites contaminated with bunker infrastructure were cheaply sold *as 'special building plots'* with the crucial requirement by the municipality of The Hague to conceal the impact of the bunker volume.

Commissioned by his friend and contractor Jan Van Kampen in 1951, Romke de Vries started dealing with a large concrete bunker measuring 22 by 11 by 5 m, furnished as a double kitchen (see Fig. 1). The demolition of this monolithic block with reinforced walls and slabs of over 2 metres thick, was budget- and technically excluded, hence it became quite a challenge to reuse this inert symbol of oppression: *'From the very beginning it was clear that an entrance on the ground floor would not be a realistic option since making holes in the construction was technically impossible. We therefore had no other option but to accept this large concrete block as a kind of artificial rock to project a bungalow on top of it. Thereby envisaging the local authorities' demand to make the bunker features disappear'* [4].

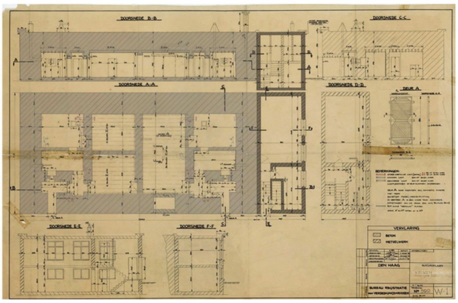

Fig. 1. Drawing of the bunker from 1948 (© *Nationaal Archief*, bunkers collection n° 2.13.167, drawing n° 592)

1.3 House on the Bunker

To integrate the colossal block into a contemporary residential program, and meet the requirements of the municipality, Romke de Vries developed a number of architectural strategies, which were studied in various preliminary designs from 1951 onwards.

He sought to create an intense relation between the house, the garden and the surroundings (see Fig. 2). The overall concept combines external staircases, terraces, vertical accents, canopy constructions, and claddings of the bunker surface with bricks, wooden planking and supports for ivy leaves. After finalization in 1955 the bunker was still functionally present but the whole resembles a remarkable, modern post-war bungalow that made a clear statement of conservation versus oblivion (see Fig. 3).

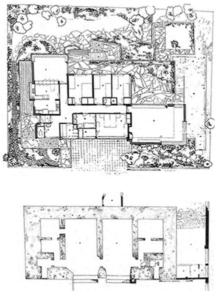

Fig. 2. Layout of the bunker (level 0) and the house (© Romke de Vries)

The house was listed [5] in 2009 and gained its place in the Top 100 of Dutch post-war monuments [6]. In 2015, Steven Van der Goes was able to buy the building directly from the Van Kampen heirs, with the intention to preserve and restore this single-family house, a process in which he is intensively involved as restoration architect. At present, the conservation works are in progress with special attention to the post-war materials and colour schemes. Also improvement of the energetic performances, efficient approach of the damage phenomena and issues of building physics were tackled.

2 Methodology

The research methodology sought to maximize the link between archival research, on-site survey and laboratory analysis of different materials [7]. Survey of the archives prior to the on-site investigation yielded valuable information based on architectural drawings, historical photographs, articles, and building specifications [7, 8]. To address further knowledge gaps, discussions and interviews with the various involved actors such as the Van Kampen heirs proved to be a valuable source of information. The on-site investigation started with mapping and survey of the bunker house to document the present situation and to obtain insights into the construction: as-built drawings, identification of the authentic materials and later adaptations, construction principles, historical colour schemes, and mapping of the damage phenomena. The survey continued with the analysis of different materials (concrete composition, wood determination, etc.) and testing of future finishes and treatments (e.g. the mock-ups of different paint systems).

Fig. 3. Historical photo of the rave façade ca. 1955 (© *Maria Austria Instituut*, Jan Versnel collection, n° 30789503364)

3 Post-war Heritage Issues

3.1 Historical Layout, Construction Principles, Materials and Colours

Romke de Vries translated the family's desire to completely separate the living space from the dining room and kitchen into an interesting layout with the bedroom hallway as buffer between the living areas [9]. The downstairs bunker was used for garage, storages and heating plant after breaching the walls with explosives.

The many detailed drawings prove that the layout, construction, material and colour scheme of the house were fully developed. Fixed furniture was customized, resulting in a prominent ensemble that has remained intact to this day (see Fig. 4). The interior and exterior finishing combines raw materials with smooth surfaces. External materials are handmade rusty brown bricks with brushed joints and exposed concrete, steel windows fixed to Afzelia posts and timber roof construction with suspended plaster ceilings and glass quilt insulation (see Fig. 5). Except for some face brickwork, tiled or timber walls and glass mosaics, all interior surfaces were plastered and painted in unique colour schemes. Kitchen and bathroom floors were originally finished with Colovinyl, the hall and corridors were paved with Norwegian slates (Alta quartzite) and all other floors with reddish Kambala (Iroko) hardwood. Romke de Vries also designed the garden layout but the planting was developed by Mrs. Van Kampen [10].

Fig. 4. Fixed furniture between the kitchen and the dining room (© Ossip van Duivenbode, 2017)

Fig. 5. Living room with raw materials, smooth surfaces and steel window frames (© Ann Verdonck)

Fig. 6. Drilling installation holes through the bunker roof in one of the bedrooms

Fig. 7. New pipework from different rooms is bundled under the bathroom floor, where the contemporary vinyl finish is replaced. (© Steven van der Goes)

3.2 Vision and Ambition

The original 1955 building phase was considered as reference for the restoration. Consequently, non-original additions and alterations form the 1970's were removed to enhance the initial concept. All installations have fallen into disuse and are out of date and are due for replacement. Turning this issue into an opportunity, a great deal of attention was given to a thorough modernisation. This approach was twofold, to meet the current 21st century technical and construction standards and to preserve all 1955 interior features such as the original radiators, switchgears and sanitary ware.

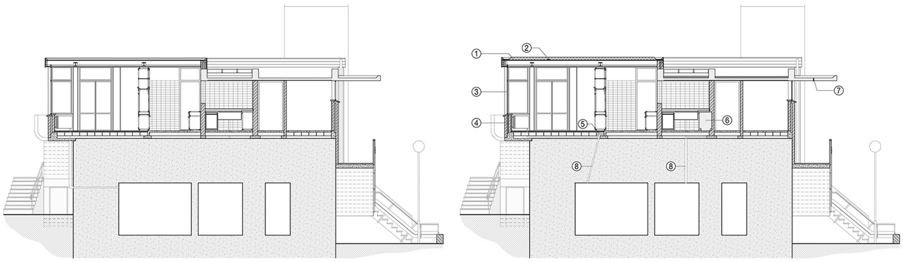

Fig. 8. Cross-section (existing/new situation): 1: 120 mm PIR thermal insulation, 2: PVC tubes for alarm and sound system wiring, 3: Low-iron double glazing with powder coated spacer, 4: 60 mm graphite EPS beads in cavity wall, 20 mm aerogel cladding behind radiator, 5: Insulated thermal heating pipes under existing cupboard, 6: New dishwasher, recessed in existing brickwork, 7: Copper pipe to detect possible leakage, 8: New boreholes in bunker roof (© Steven van der Goes)

Fig. 9. Reconstruction of the ceramic sink tiles

Fig. 10. Terrace along the kitchen and entrance with a view on the restored railing

Particular attention was devoted to the development of a carbon neutral installation concept. Initial promising ideas, e.g. to make use of the large floor area or thermal mass of the bunker for a new heating system, were quickly abandoned since they involved opening up the existing finished floors or resulted in the creation of useless cold rooms in the bunker. Instead, the original energy concept with heat emitting radiators under all windows was maintained and optimised, using some specific characteristics of the house. First of all the vast roof surface was an important advantage but also the excess of storage space in the bunker provided plenty of room for the installation of photovoltaic cells, solar collectors and a large scale pellet silo feeding a biomass boiler without compromising the historic image of the listed monument. In combination with the strategy of adding as much thermal insulation as possible without altering the appearance of the house, enough sustainable energy could be generated on site for the future household, including electric car charging.

4 Restoration and Conservation Options

4.1 Phased Approach

Because of the wide variety of conservation and restoration work on a relatively small surface, construction process was split up in two stages. The first phase mainly involved all major stand-alone work by specialists, including concrete, terrazzo and brickwork repair, restoration of the external stone staircases, and repair or maintenance work of the steel frame windows, railings and fences (see Fig. 11). In this stage defects could be mapped and tackled on-the-go taking time for thorough additional research and sampling (e.g. brickwork, pointing and repair mortars, reconstruction of ceramic tiles (see Fig. 10) without interfering with the more coherent and consecutively executed work in the second phase. Planned and coordinated by a main contractor, this second stage included restoration of the building envelope (renewal of the roof coverings, flashings and fascia boards), technical installations and the restoration and reconstruction of interior finishing, including the fixed furniture and a meticulous reconstruction of the original colourful paintwork. This two-way process enables implementation and follow-up to be executed in a coherent and consistent manner.

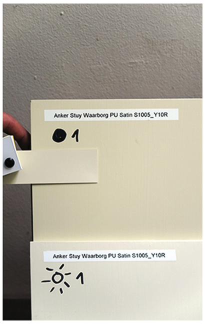

Fig. 11. Mock-up of the paint systems (yellowing) (© Ann Verdonck)

4.2 Technical Upgrade

A thorough technical upgrade required bespoke solutions for every detail. Extensive investigation with regard to the piping system, concrete works, steel components and the improvement of the energetic performance was carried out.

4.2.1 Piping System

The design of a new piping system posed a major challenge since every single connection asked for a different solution. Irreversible demolition work was minimised by using modern flexible pipes, concealed in cavities of the existing built-in furniture and beam and block flooring. In order to lead the new pipes through the thick concrete roof of the bunker, boreholes were drilled, hidden under cupboards and vinyl flooring (see Figs. 6 and 7). This approach made it possible to dismantle the central heating pipes from the 1970's outside the bunker walls.

4.2.2 Concrete Restoration

For the repair and consolidation of the concrete, an iterative process was followed (cleaning > inventorying and testing > repairing > repeating steps). The damage found related mainly to surface issues caused by moisture penetration, cracking around anchorages and corrosion of the reinforcement (a minimum concrete cover of 2,5 cm for beams and 1 cm for other concrete work was prescribed on building plans). Loose or cracked concrete parts were removed, the exposed reinforcing bars were de-rusted and the concrete surfaces were repaired with a polymer modified cement-based repair mortar matching the colour of the existing concrete.

A number of critical details have been improved in order to minimise water infiltration and to prevent future damage. All steel anchors have been drilled out and replaced by stainless steel. Furthermore, the concrete canopy has been provided with spouts to detect possible leaks at an early stage. The roof garden is completely re-executed as a modern roof garden system, including thermal insulation, drainage board and substrate, within the existing measurements. With respect to the external staircases, the quartzite risers and steps have been removed in preparation of the concrete repair. After the concrete works, steps were cast using a low-shrinkage mortar and provided with a waterproof membrane to prevent water infiltration. Finally, the quartzite parts have been replaced and re-joined.

4.2.3 Steel and Metalwork

Corrosion of steel windows and doors was generally limited to the most vulnerable parts, e.g. behind skirting boards and cracked putty. After labelling and dismantling all moving parts were blast cleaned, repaired and corrosion protected off site. As a rule of thumb, all steel profiles showing less than 30% material loss were re-used and protected by means of a duplex system for corrosion protection: a combination of a thermal sprayed zinc layer and a paint coating. After re-installing, adjusting and glazing the doors and windows, all parts were hand painted on site. The use of brushed alkyd paint for the final layers meets the aspect of the historical paint finish.

Vulnerable (and thus deteriorated) parts of the bunker house were hard to preserve and partially replaced by new stainless steel (AISI316). The original wire fencing was heavily corroded and, as many parts were missing, completely reconstructed in stainless steel flat top wire mesh, tailor made with the original aperture and wire diameter. The rainwater drainage system had become a mix of steel, zinc, lead and PVC pipes and was reconstructed with zinc drainpipes and stainless steel wall brackets according to historical photographs, drawings and remnants of the original system. All elements were painted *'grey as* [the clients] *Studebaker'* as originally prescribed, recreating a harmonious façade [11].

4.2.4 Thermal Insulation

Addressing the issue of energy sustainability in the bunker house the *Trias Energetica model* - developed by the Delft University of Technology - was used. The first challenge was to achieve a substantial reduction of energy consumption. To minimise heat losses through the existing roofs and cavity walls a combination of thermal insulation materials was installed following thermal bridge calculations. The worn fascia boards required replacement. Making each of the three stacked boards 1 cm higher allowed the installation of 12 cm PIR insulation panels on the roof (see Fig. 8). Without altering the heritage values the thermal resistance of the roof could be upgraded from 1.5 to 7.0 m^2 K/W. Cavity walls were filled with graphite EPS beads and in addition two layers of aerogel-based insulation sheets with a stucco finish were applied behind the radiators. These invisible modifications resulted in a more than five times higher thermal resistance at the spot of the heat source. Finally, the existing single glazing has been replaced by double-glazing with a 9 mm cavity width. For the time being, it was decided not to insulate the hollow spaces between the concrete floor and the bunker, as no guarantee could be given towards a uniform distribution of insulation material.

4.3 Interior Restoration

Considerable time and effort was spent on restoring the exceptionally well-preserved interior. Substantial non-original additions and alterations to the initial design were limited to the removal of Colovinyl tiles and the addition of easily dismountable pinewood panelling in two of the bedrooms. More importantly, successive paint works significantly changed the remarkable colour scheme (Fig. 9).

The discovery of a detailed list related to the interior paintwork specifications [11] and the results of the architectural paint research [12] were crucial in the decision to choose for a full reconstruction of the historical colour scheme. Strong emphasis was put on the nature of the future paint and application system. Restoration test-strips and mock-ups of different paints were indispensable to determine the adequate colour, binder, gloss, and texture comparable with the used post-war alkyd resins. Also the yellowing resistance was tested by exposing sample sets simultaneously during several months to sunlight and to the dark (see Fig. 11). The tests showed that a contemporary water-based acrylic-based paint corresponds most closely to the aspect of the historical paintwork with alkyd resins.

5 Conclusions

Architect Romke de Vries, in close collaboration with his client Jan Van Kampen managed to convey his passion for the bunker house project with contagious enthusiasm. The result is an outstanding overall design combining both old and new constructions, interior design and garden layout. His innovative and progressive post-war ideas were initiated to develop an energy-friendly restoration strategy with respect to the heritage values of the bunker house. In preparation to the restoration work and during execution the key issue focused constantly on the benefit of the monument. It was vital to assume a cautious and reserved attitude towards the design process. Different approaches were defined, discussed, budgeted and finally selected. Finally, the preliminary research was of mayor importance and slowly but surely the monument itself provided appropriate sustainable solutions.

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