Construction as a prototype: the novel approach by Sigurd Lewerentz to using building materials, especially for walls and windows, 1920-72.

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Abstract

This paper analyses the experimentation in construction by Swedish engineer-architect Sigurd Lewerentz (1885-1975) by tracing the successive simplification of window frames and doors and the rethinking of wall construction between the late 1920s and the early 1970s. It explores what he wrote about construction in relation to his built projects, and compares his perspective with that of his contemporaries. The firm manufacturing metal fittings that he set up in mid-career reflects his interest in the combined use of the latest technological developments and everyday materials, propelled by an aesthetic drive to build barely-visible frames and structures, and to prioritise content: signs and everyday life. The chapels of St Gertrud and St Knut built in Malmö in 1943 marked a turning point in his career, when he combined walls, doors and windows, exposing the construction techniques but not all the materials, and integrating his construction solutions with the surroundings. After 1955, Lewerentz further experimented with unusual combinations of glass, timber, bricks and mortar, while seeking continuity with Swedish building tradition. His construction methods define a framework of research in which rethinking the use of daily materials exemplifies a way of innovating, as well as a critical stance to many contemporary architectural developments of his time.

Keywords

Sigurd Lewerentz, construction, window, wall, prototype, materials, construction method, Sweden

Introduction

The experimental endeavours in construction by Swedish engineer-architect Sigurd Lewerentz (1885-1975) have often been analysed individually. Considering his designs for walls and windows as part of a process sheds new light on the steps leading to the construction solutions adopted in his latest projects. This study reveals how joints in windows and walls played a significant role in the process of simplifying the final construction.

"Dear Mr. Ponti, ... I am living in the south of Sweden at the moment as I have some work to do here. Therefore I must ask you to write to Byggmästarens förlag, ..., who have all the material concerning the Marcuschurch in Skarpnäck".[1]

This reply by Lewerentz to Italian architect Gio Ponti illustrates some of the interest that Lewerentz's chapel at Björkhagen had raised internationally. Built between 1956 and 1964 with high-fired Helsingborg bricks using thick mortar joints, this church attracted the attention of architects. Before its construction, Lewerentz had already received considerable recognition for his achievements in architecture and had been awarded a number of honorary medals in Sweden, Denmark and Germany.[2]

Letters from architects interested in working at his office had already begun arriving from Great Britain, the US, Hong Kong and Australia.[3]

While large windows, white walls and illuminated interiors had been a main construction trend throughout the 1920s and 1930s in Sweden, thereafter new public buildings often featured dim atmospheres, small windows and dark walls. Material and fuel shortages often encouraged the use of bare brickwork, coarsely rendered surfaces and reduced window areas.[4] Novel construction methods were combined with the Swedish artisan tradition resulting in an extensive use of brickwork, angled roofs and material patterns. As one of several architects who embraced the opportunity to explore innovative construction solutions, Sigurd Lewerentz achieved international impact through his wall designs and his research into fenestration and fitting systems, consolidated through his own production company.

This paper analyses Lewerentz's experimentation in construction by tracing a process of simplifying window frames and the rethinking wall erection between the late 1920s and the early 1970s. Through a case-study approach, field data retrieval and mining of texts and drawings from historical archives, the paper assesses the design process for walls and windows, in order to identify core elements and describe a methodology in Lewerentz's way of innovating in construction. In the words of Swedish architect Bengt Edman, "everything that he did caused surprise by the innovative character of its solutions, and opened up new prospects for the colleagues who followed his work".[5]

This research explores Lewerentz's construction methods through three key periods in his career:

- An initial period starting around the end of the 1920s, during which Lewerentz founded his brand Idesta, when he focused on the design and production of metal windows, doors and fittings. I analyse Lewerentz's production of walls and windows as part of an emerging interest in functionalism across Sweden.
- Next I examine Lewerentz's design and construction of the Chapels of St Gertrud and St Knut built in Malmö in 1943. These were among the first projects in which he used a variety of materials in new ways and simplified the window frames and I argue that these chapels marked a turning point in his career.
- This approach was further explored in subsequent projects between 1945 and 1969 in which the architect simplified the window frames. In parallel, the walls were also gradually simplified in terms of materials but featured an increasing number of mortar joints and additives. The Churches of St Mark in Björkhagen, Stockholm, and St Peter in Klippan, the flower kiosk and the warden's house at Malmö Eastern Cemetery are examined with regard to their different contributions to the research process for wall and window construction.

The founding of Idesta

Browsing through Lewerentz's drawings at the Swedish Centre for Architecture and Design, one of the first impressions they give is his careful approach to detail. A case in point is a 1:1 plan and cross-section of a key hole belonging to his 1922 designs for the celebrated Woodland Cemetery in Stockholm.

The general appearance of Lewerentz's buildings changed radically between the early 1920s and 1930s, from his neo-Classical designs of the 1925 Resurrection Chapel in this same cemetery to his austere Social Security Administration building in Stockholm, built with white-washed mortar render façades. Despite the apparent change in Lewerentz's approach to construction in the late 1920s, his careful attention to detail remained a common thread across all his different construction methods.

1930 signalled the breakthrough of modernism in Sweden as reflected, for example, in the Stockholm Exhibition, organised by the Swedish Handicraft Association to show applied art, handicrafts, domestic craft, dwellings and objects for use. Its General Commissioner was art historian Gregor Paulsson (1889-1977), and the Chief Architect was Gunnar Asplund (1885-1940), who had been Lewerentz's partner in the 1915 winning entry for the Woodland Cemetery.

Although Lewerentz did not have good memories of this show at the end of his days,[6] the Stockholm Exhibition did mean a successful start for his firm *Stockholm Ljusreklam AB,* founded just one year earlier with engineer Claes Krueger, to design and build illuminated signs and display stands. Unlike most of the exhibition buildings which were built with timber frames clad with cement and asbestos, the prominent exhibition mast designed by Lewerentz, located in the centre of the main square, was a bare metal structure to which different items were attached, including an elevated green and yellow newspaper kiosk, a clock, illuminated signs all the way up, and topped by the Exhibition logo, also a Lewerentz design. (Fig. 1) The four-sided lattice mast marked the beginning of a lifelong exploration for

Figure 1. Mast at the 1930 Stockholm Exhibition. Architect: Sigurd Lewerentz. It illustrates his aim to reduce visibility of surfaces. Source: The Swedish Centre for Architecture and Design's collections. Photographer: C. G. Rosenberg.

Lewerentz: the reduction in visibility of the surfaces of certain parts of his architectural designs, especially doors and windows, as demonstrated in his later designs for the windows of St Petri's Church and the flower kiosk at Malmö Eastern Cemetery. The mast illustrated a theme he addressed throughout his career: how form, as perceived by users, is a fundamental part of an object's function.

The Stockholm Exhibition was, as Kenneth Frampton has argued, "a modern set piece that was as generously open and popular in its general atmosphere as it was functional in its tectonic detail".[7] Among the numerous designs by Lewerentz for this exhibition—from the exhibition posters and logo, to the interior of a General Motors bus—some subtly subverted the sweeping white surfaces and flat roofs used in the show. Asplund, Paulsson and other architects contributing to the show had also found a benchmark in their visits to the recent Weißenhofsiedlung in Stuttgart, coordinated by Mies van der Rohe, and Törten housing, in Dessau, by Walter Gropius, a project that was also publicised in Sweden's leading architectural journal, Byggmästaren.[8] By contrast, Lewerentz's display stands for the PUB and Finbruken department stores, for which he designed a mono-pitched metal roof structure with a large sign attached to the cornice, had little in common with the German exhibition. In Stockholm, Lewerentz showed how his interpretation of modernism, *funkis* as it came to be known in Sweden, and its motto "form follows function", was a basis for and the beginning of his personal exploration of construction methods.

Lewerentz, ever enthusiastic about practical skills and distrustful of excessive theoretical speculation,[9] had grown up in the industrial environment where his father worked as manager of a glassworks.[10] Lewerentz considered himself an architect-engineer,[11] following his mixed training as an engineer at Chalmers Technical School in Gothenburg, and as an architect at the Fine Arts Academy and at the *Klara Skola*, both in Stockholm. Lewerentz completed his training in the industrial surroundings of his father's glassworks, and working in Berlin and Munich for Bruno Möhring, Theodor Fischer and Richard Riemerschmid, the latter two of whom were directly involved in founding the *Deutscher Werkbund*, the professional association dedicated to the improvement and standardisation of industrial products.

In 1930, *Stockholm Ljusreklam AB* changed its name to *AB BLOKK* and included more partners and broadened its scope to produce Lewerentz's own window and door patents, under the brand name of *Idesta*. The name originated from *id est* or "that is", following a Swedish trend at that time of forming acronyms from Latin words.[12]

AB BLOKK supplied various building components used in the construction of the Social Security Administration building in Stockholm, for which Lewerentz had won first prize in the 1928 design competition, and which was completed in 1932. A cubic volume with clean-cut wall openings in a flat plastered façade, the building was initially conceived as a steel frame construction with curtain walls in reinforced concrete. Due to budget constraints, however, only the courtyard was built in that way.[13] Windows were built according to Lewerentz's patents; initially, he had envisioned a design in which each window was divided into five sections of glass panels. However, the final design was a simpler double-glazed window, probably due to ongoing budget constraints.

In contrast to the celebrated success of the Social Security Administration building, Lewerentz designed a number of shop windows in 1930-31 which gained little international attention. However, these projects were effectively a series of short experiments in door and window frame design, for which he carefully detailed the metal profile frames, sometimes in a combination of metal and wooden framework and separating ventilation from the larger glass panels. (Fig. 2) His numerous 1:1 drawings of elevations, plans and cross-sections specify the construction of window frames using L-shaped metal profiles, such as a 15×15×4 mm, screwed into an oak strip and combined with mastic. The thinner side of the profile was left visible, so that it would be seen to be as small as possible.

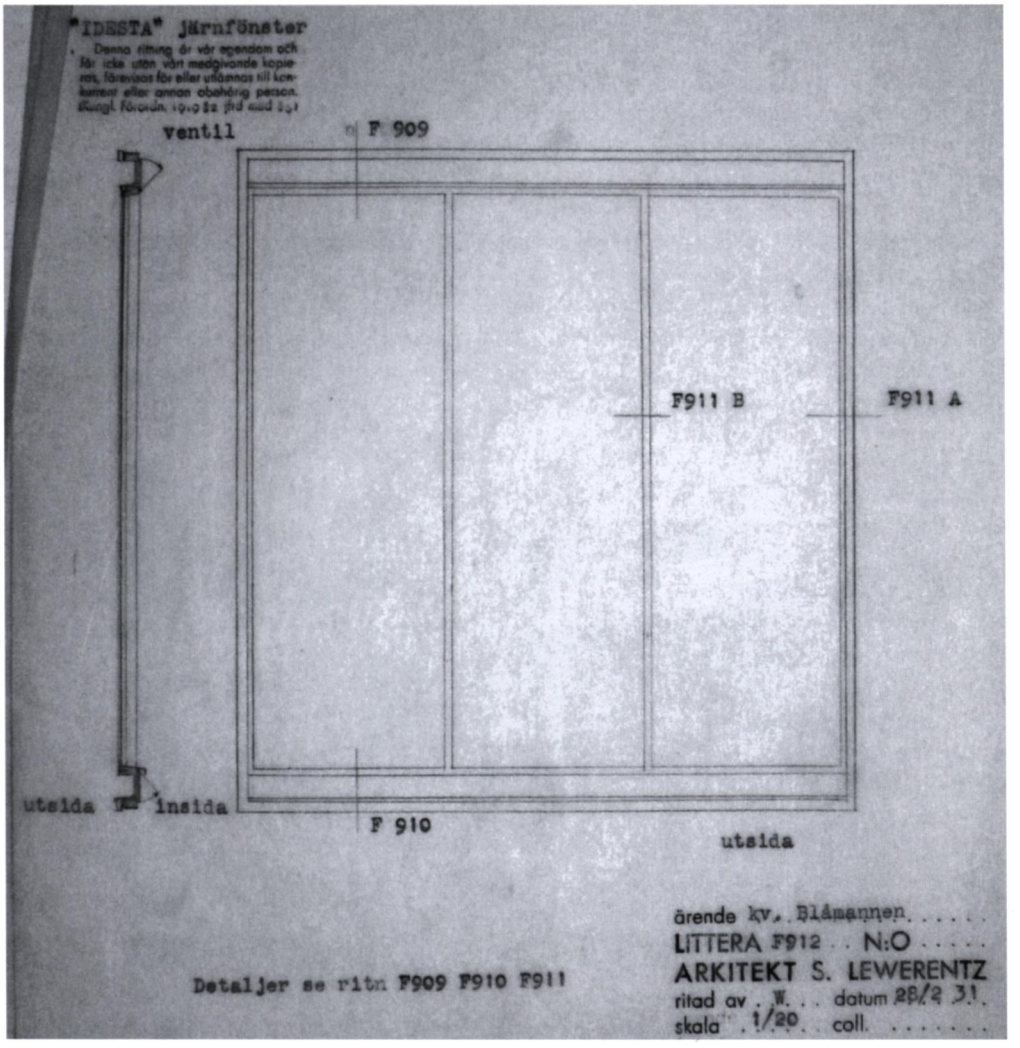

Figure 2. Design of a shop window at Kv Blåmannen, Stockholm, 1931. Architect: Sigurd Lewerentz. The ventilation is separated from the main panels, and profiles are minimally visible. Source: The Swedish Centre for Architecture and Design's collections. Photographer: Unkown.

These projects seem to have little in common with Lewerentz's 1925 Resurrection Chapel whose entrance was covered with a portico of Corinthian columns. During the transformative 1920s, Lewerentz designed a joint competition entry with Osvald Almqvist (1884-1950) his former fellow student at Klara Skola. Almqvist had been involved in a standardisation committee for a research project concerning "Practical and Hygienic Dwellings", and his functionalist power stations at Hammarforsen and Krångforsen (1925-28) may have had a great influence on Lewerentz. Lewerentz's scant explanations make it difficult to determine what forces drew him to transform his construction methods in the late 1920s to achieve an "elected poverty of means", in the words of British architect Colin St John Wilson, who suggested that austere aesthetics had become part of Lewerentz's ethics.[14]

It may be no mere coincidence that during those years Lewerentz was also strongly involved in the landscape design of both the Woodland Cemetery and Malmö Eastern Cemetery. In both projects, he used natural resources, pre-existing woodland and the plains, as a means to define spaces. He thus reduced the material requirements of these large-scale projects developed at a time of intermittent crises in 1920s Sweden. For Lewerentz, the two projects must have been a lesson in building with reduced materials means.

Lewerentz's 1930s construction of windows and doors reflects a reduction of forms and materials to an essential use, but also something else: they become thresholds with the user at the centre. The shop window of the Konsum Store is not exactly a reduction of means: the door frames open against a uniform glass surface, encased in marble cladding. (Fig. 3) With this construction method, Lewerentz emphasised the contents behind the windows and the sign, and the construction elements remain in a secondary plane. The simple shop window frames the complexities of the everyday life within.

Figure 3. Konsum Store, c.1930. Window designed by Lewerentz. The construction emphasizes the contents behind the windows and the sign. Source: The Swedish Centre for Architecture and Design's collections.

Mies van der Rohe's structural rationalism rejected typological functionalism and Le Corbusier's aesthetic traits were expressions of an underlying ethos and symbolic content of a utopian dream.[15] Alvar Aalto's construction methods aimed at making users appreciate "the value of the fleeting moment", by accommodating them and slowing them down,[16] while also explaining that his idea of hell was when "mechanization takes command".[17]

Lewerentz's efforts in his construction methods were not an expression of formal virtuosity. His few writings give account of his intentions to preserve what is already found in a site: "The landscape will not be disturbed by the somewhat imposing stature of the size of the chapels to be built …",[18] referring to his design of the twin chapels in 1945. In other writings, he blamed the layout of masonry in cemeteries: "and so it often happens that cemeteries lack the peace and quiet necessary for places commemorating the dead",[19] advocating the study of Swedish tradition. These texts imply that Lewerentz's own utopia was preserving the complexities of life and nature against all-eroding constructions.

When examining one of Lewerentz's watercolours from the 1930s, we can see that his window frames are barely visible. (Fig. 4) In fact, they form an almost transparent layer between the existing building and the persons around it. The letters of Lewerentz's illuminated signs were hung directly against the existing building, avoiding the need to construct another background. Looking again at the Stockholm Exhibition mast, the lattice structure becomes an airy construction, a layer of illuminated signs overlapping the atmosphere of the exhibition in the background.

Figure 4. Watercolour of Feith's patisserie-café, Sveavägen 21, Stockholm painted by Lewerentz c.1930. The window frames are barely depicted, whereas the people and the sign gather importance in the scene. Source: The Swedish Centre for Architecture and Design's collections. Photographer: the author.

In 1933, Lewerentz took over the company *AB BLOKK*, as the other partners had lost interest. He then became personally involved in controlling the entire process of design and construction of the fenestration and metal fittings. By 1934, Lewerentz had already won first prize in numerous architectural competitions in Sweden, his work was featured in the New York Architectural League and he was one of the few invited to participate in the design of the Bromma Aerodrome in Stockholm. In short, he had gained considerable recognition on Sweden's architectural scene. However, his commitment to fittings design was such that he purchased a factory building in 1940 to house the company, setting up home in the penthouse.

The construction of the twin chapels St Gertrud and St Knut in Malmö

Upon the establishment of Swedish Social-Democracy after 1932, construction research flourished in parallel an extensive programme of building between the 1930s and 1960s. Large housing policy programmes were developed and municipalities required new administrative buildings, schools, libraries and religious premises.

In the late 1930s, important changes took place in the use of materials in Sweden, in order to address issues with flat-roof, white-washed façade construction. The Second World War affected Swedish construction work, which was seriously cut back.[20] Sune Lindström (1906-1989) built a town hall and hotel at Karlskoga in which he employed red brick in Flemish bonding, tarred wooden shingles and local slate.[21] In 1937, Asplund finished the construction of the State Bacteriological Laboratories, a large group of specialised buildings using a then almost-forgotten material - soft yellow brick - for the façades.[22] The stables were built with low-pitched roofs and corrugated asbestos-cement cladding.

In 1936, the City of Malmö commissioned Lewerentz to build a belfry at Malmö Eastern Cemetery. The initial proposal was soon enlarged to include an extension to the crematorium he had built previously: two chapels where ceremonies could be held simultaneously, an extended service area and a belfry. The Committee subsequently decided that the chapels should be placed alongside the existing crematorium, but separate from it, with a waiting-room to the west for protection against the cold winter winds.

Lewerentz built the two Chapels of St Gertrud and St Knut between 1941 and 1943. They were detached from each other and placed side by side, facing north towards the main road across the cemetery. This layout resulted in the entrances to the chapels being visually separate from the crematorium behind. The chapels had seating for 140 persons.[23]

Only a few years before, between 1933 and 1936, Lewerentz had designed Villa Edstrand. He had begun with a modernist white volume but eventually ended up with a bare brick villa with steel beams, various sliding windows and glass canopies. The staircase reflects Lewerentz's aim to expose building materials and achieve thinner surfaces. (Fig. 5)

The Malmö Cemetery Committee's request that the chapels be clad in marble might have presented a challenge for Lewerentz's then new aim to expose materials and construction methods. The foundations, columns and roofs of the chapels were all made of concrete.

Lewerentz adjusted his design to the Committee's request by cladding the exterior of the chapels in horizontal slabs of marble from Gropptorp near Stockholm, all held in place by concrete. (Fig. 6) Chips of marble were embedded in the mortar, built along the brick wall and held together by iron cramps, so that walls acquired a total thickness of 54 cm. The cladding layer therefore became a constituent part of the walls.

Figure 5. Villa Edstrand, Falsterbo, near Malmö, 1933-37. Architect: Sigurd Lewerentz. The thin staircase reflects Lewerentz's aim to achieve visually lighter structures. Source: The Swedish Centre for Architecture and Design's collections. Photographer: Matti Östling.

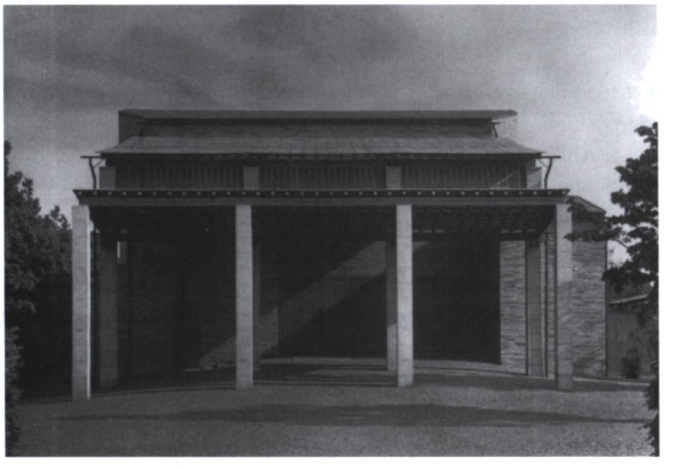

Figure 6. Chapel of St Knut, Malmö Eastern Cemetery, 1941-43. Architect: Sigurd Lewerentz. Northern façade. Source: The Swedish Centre for Architecture and Design's collections. Photographer: Kidder Smith.

As usual, Lewerentz controlled all construction details of this wall, requiring the marble supplier to provide pieces measuring from 2 to 6 cm in thickness, up to 14 cm wide and with a minimum length of 22 cm. The colour had to be within a range between grey and green, and white marble was not allowed.

Regarding the cladding of the portico pillars, Lewerentz embedded a key stone in the inner concrete of the pillar in order to hold each slab of marble cladding in place. (Fig. 7) Fragments of Ekeberg marble were mixed with the lime mortar. The key between the larger pieces of marble cladding highlights the construction method of the pillars, revealing the concrete content in which they are embedded. Although Lewerentz did not show all the materials, he did expose the method of construction.

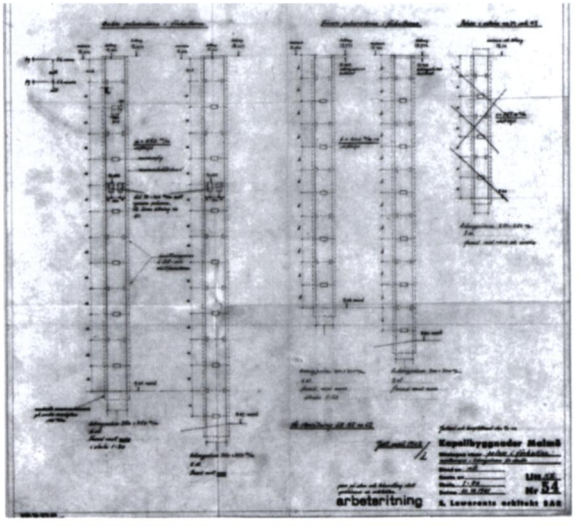

Figure 7. The Chapels of St Gertrud and St Knut, 1941. Architect: Sigurd Lewerentz. Cladding of the columns of the portico. Source: The Swedish Centre for Architecture and Design's collections.

The composition of these pillars reflected a novel approach to construction in Lewerentz's career: a rethinking of the superposition of materials and the unnecessary exposure of them. The column shafts also resembled trees, as Alison Smithson remarked: "Including the pine trunks in his realm ... with column-shafts-that-are-the-built-world, is something Lewerentz invented ... and extended at Malmö."[24] Yet similarities with the setting may be traced still further, since the way the pieces of cladding interlock at the pillar resembled traditional Swedish construction with timber, in which logs are interlocked to stabilise the entire structure. Lewerentz's previous construction solutions featured scarcely visible frames and bare structures in the setting, whereas these columns reflected the surroundings.

By the time the twin chapels were constructed, Lewerentz had been specialising in designing a variety of doors and windows at his own workshop for over twenty-six years. The glass canopy for the waiting rooms of these chapels reflects how he had further explored ways to reduce the visual impact of the frames. (Fig. 8) The glass panels of the roof rest directly on the vertical glass panels, supported by vertical jambs.

Figure 8. Chapel of St Gertrud, Malmö Eastern Cemetery, 1943. Architect: Sigurd Lewerentz. Waiting room. Photograph by the author.

For the interior of the chapels, Lewerentz chose to hide the glass panes of the window and their simple wooden frames behind brick walls, making openings at an angle, so that the brick disguised the window frame. (Fig. 9) These windows mark another turning point in Lewerentz's career, after which he would further explore how to make the glass panels interact with the wall openings to reduce the visual impact of the frames even further.

Once more, Lewerentz emphasised his aim to place the complexities of everyday life at centre stage: "great care is bestowed upon the desire that ceremonies in both chapels will proceed in undisturbed quiet".[25] For this purpose, construction would play a significant role in guaranteeing that tranquillity and Lewerentz visually blended construction into the background, giving it a second place to ceremony. As a result, Lewerentz built the inside of the chapels with soft yellow clinker brick walls, originally from Lomma, in southern Sweden, forming an elongated octagon measuring approximately 16 x 12 m. In 1939, Lewerentz even presented the committee with a letter from an expert engineer, who advised how to reduce the risk of acoustic interference during ceremonies. Waiting rooms were located near the entrances and the doors, which initially opened towards the lobby, would finally open outwards onto the portico in order to reduce noise in the lobby. Furthermore, timber was incorporated into the furnishings, structure, pavement and ceiling of the chapels, to improve the acoustics of the rooms.

The outer doors were built from a grille of timber mullions attached on both sides of a glass panel, allowing lines of light in. The door panel was lighter than a solid wooden panel and the stiles were visually similar to the jambs.

Figure 9. Chapel of St Gertrud, Malmö Eastern Cemetery, 1943. Architect: Sigurd Lewerentz. Interior, showing the windows. Photograph by the author.

The interior walls of the chapels, built of similar soft yellow bricks, resemble those at Grundtvig Church (1913-40), in Copenhagen. In fact, years later, Lewerentz would choose some of the furnishings originally designed by Kaare Klint for the Grundtvig Church for use in his church in Björkhagen.[26] Lewerentz's choice of these bricks from Scania, a region that has been historically connected to Danish traditions across the Oresund Strait, is another way of incorporating his construction into the larger setting.

Lewerentz's later career

After 1945, Sweden's housing shortage was addressed by the Swedish Parliament through a major building programme. Official national loans were granted subject to norms and regulations, in order to ensure high building standards.[27] During the 1940s and early 1950s, traditional construction elements appeared throughout Swedish architecture, with a proliferation of ornamental brickwork and angled roofs, with façades of coarsely finished surfaces, colours and patterns.[28] The choice of brickwork or other more traditional materials was often the result of the scarcity of steel for reinforced concrete, and shortages of asphalt forced architects to choose pitched roofs.[29] For example, Sven Backström and Leif Reinius built several brick-fronted terraced apartments between 1946 and 1952. Fuel shortages also resulted in choosing smaller windows.[30]

Parallel to Lewerentz's building designs, his brand name *Idesta* became popular with other architects in Sweden. Among these was the architect Peter Celsing (1920-74), head of Spårvägar (Stockholm's tram and local railway authority), who built a number of suburban metro stations and commissioned Lewerentz to take care of the ticket booths. At his Eskilstuna factory, Lewerentz designed and manufactured a set of simple stainless-steel cubicles, with no more than a set of glass panes in the upper half, placed flush with stainless-steel panels in the lower half. (Fig. 10) At first sight, these strikingly simple booths may appear to have little in common with Lewerentz's previous and subsequent projects, having no rough surfaces and no apparent thinning of profile edges.

Figure 10. Ticket booth for Kyrkogården Station on the Stockholm subway system, 1950. Architect: Sigurd Lewerentz. Lewerentz placed the steel and glass panels flush. Source: The Swedish Centre for Architecture and Design's collections. Photographer: Sune Sundahl.

The construction of the subway system between 1945 and 1957 was instrumental to the regional development of Stockholm's suburbs. Satellite towns were planned to connect with central Stockholm through a radial arms of a 100-station subway system. Nevertheless, many Swedish architects criticised the first generation of new suburban towns.

Lewerentz's glass panes in the booths are positioned flush with the surface, with a deliberate crude simplicity. Devoid of detail or spectacular volume, they are efficient and resistant enough to be used by the public. Reading Lewerentz's critical stance towards many of his contemporaries, these simple volumes could even be regarded as a critique of the entire grandiose scale of the urban operation. Indeed, he also allowed the project of his friend and junior, Celsing, to play a central part in the scene.

The Church of St Mark, Björkhagen, Stockholm

In 1955, Lewerentz was invited to participate in a competition for a church and parish facilities in the parish of Skarpnäck in Björkhagen, to the south of Stockholm. After winning first prize, Lewerentz was requested to enlarge the area available for parish activities, to insert a small pond between the two buildings of the complex, and to redesign the belfry.

Lewerentz designed two buildings to be located side-by-side and separated by a courtyard. One of the buildings contained the offices and the belfry, and the L-shaped building opposite housed the church and rooms for parish activities. The main access to the church was to be through a door in the south wall. Lewerentz designed a separate exit, leading to a small auditorium which he described in his proposal 'Interlude':

> "The façades of the building are proposed to be of warm red brick against which the white trunks of the birch trees would be beautifully delineated. The inner walls of the church and the parish hall are of the same brick, as is the church roof, vaulted between reinforced concrete girders".[31]

The way the bricks would be combined triggered a whole series of experiments. The structures were directed by building engineer Professor Hjalmar Granholm, who had written a dissertation on masonry and masonry techniques. Granholm explained how Lewerentz's aim to erect a building of brick masonry, with an unusually shaped roof and very large wall openings, triggered several design problems.[32] The vault roof slopes were built alternately in different directions, and each vault was laid up independently with wide joints. I-section beams were set to support the three-part vaults and these beams were supported by the walls of the longer side of the church, that is, in the south-north direction. The formwork for the arches were made of fibreboard, which was moved gradually as the work progressed. Flooring, walls and ceilings, particularly within the church, were made of dark high-fired Helsingborg brick, and services and appliances were mounted on the bare brick surface.

To achieve a homogenous brick interior, large steel-reinforced brick beams were placed over the opening between the nave and the transept; the longest spanning 10.7 m.[33] The beams included shear reinforcement set at 45 degrees which also provided anchoring for the tensile reinforcement in the beam's underside, following innovative models already developed in concrete beams. Reinforced brick beams were used for fairly small spans and for moderate loads, such as over the window openings.[34] The visual result is that the heads of the openings appear unsupported, distancing Lewerentz's construction method from other Modern Movement architecture that aimed to expose the construction logic.[35]

The construction engineer Sven Peger explained how it was important to dampen the bricks in advance, in order to prevent cracks between the brick and the mortar. For the twin chapels, Lewerentz had begun to explore the possibilities of mortar, but now mortar became a key element in the construction and was

sometimes even thicker than the bricks themselves. Peger explained that mortar Class A was based on a ratio 1:1/4:5 (cement:limestone:sand), but that recent theories showed that mixing ratio of 1:1/2:4 1/2, preferably with the addition of a chemical air mixer, could achieve better results of adhesion in the masonry.

Lewerentz managed the construction site from Monday to Saturday, handling all construction problems.[36] He even asked master mason Jojje Anderson to read Granholm's dissertation and to pass it on to the other masons. Anderson would later state that "no one gets to join this team of masons without having read your dissertation".[37]

In the same year Lewerentz that received this commission, his son Carl Sigurd Lewerentz took over the management of his factory. Sigurd Lewerentz did, however, continue his research on fenestration systems, designing a variety of window frames at the complex of the Church of St Mark, reducing and simplifying parts of the frame in various ways. At the church, the windows were made by fixing the glass, with an angled steel bar on each side, onto the interior surface of the brick wall. (Fig. 11) The rooms were ventilated by a forced-air system running across the cavity of the wall. Lewerentz further explored the path he had initiated at the Malmö chapels, exposing only some parts of the construction, reducing frames and making windows an integral part of the brick-wall elements.

Figure 11. Church of St Mark, Björkhagen, Stockholm, 1956-64. Architect: Sigurd Lewerentz. Eastern façade. In some of the windows, the glass panel is fixed directly onto the wall. Photograph by the author.

Some the church doors, made of six laminated-timber panels, painted black, with visible joints, were strikingly simple when compared to Lewerentz's copper plates at the Enköping Cemetery Chapel or even the intricate set of mullions he used for the doors of the twin chapels. These black doors at St Mark's were similar to the traditional black doors of Swedish farms, and thus were a statement of Lewerentz's admiration for traditional Swedish construction methods at a time when the entire city centre of Stockholm was being demolished and old buildings were being replaced with skyscrapers, following the urban plan devised by the architect Sven Markelius (1889-1972). Lewerentz's Church of St Mark was awarded the Kasper Salin Prize in 1962.

St Peter's Parish Church, Klippan, near Helsingborg

Before the works at Björkhagen were finished, the 77-year old Lewerentz received a commission to build a parish church at Klippan, in the southern Swedish region of Skåne. St Peter's Parish Church was built between 1962 and 1966 and consisted of two buildings. An L-shaped building housed the rooms for parish and administration activities, and a rectangular building on the leeward side contained the church, with two wings and the belfry, the sacristy and the choir assembly rooms on one side, and a smaller chapel for performing marriage ceremonies and a waiting-room.

From 1960 to 1975, the Swedish building-industry was transformed by large construction programmes, with some fifty national commissions being awarded to cover the construction of dwellings. At that time, as Swedish architect Claes Caldenby has argued, church building came to be the most important research field for architects.[38] Indeed, the growth of city suburbs led to the commissioning of a great number of churches. Together with Lewerentz, Celsing used dark-fired Helsingborg bricks in his Church of St Thomas, in Vällingby, which was consecrated in 1959.

Lewerentz visited the construction site for St Peter's Parish Church for the first time when the concrete foundations had already been laid and a test section of brick wall was to be erected.[39] He had carefully planned to erect the building using an innovative brick module with a larger size. However, the wrong bricks were delivered to the work site and the runs had to be recalculated to fit the masonry openings, using broader mortar joints.

St Peter's Parish Church was also built with high-fired Helsingborg bricks. Once again, the rule was that no brick was to be cut. Flakes of slate were added to the mortar mix to reduce shrinkage. Lewerentz again collaborated with engineers Hjalmar Granholm and Sven Peger, and also with Jan Rosenberg and Ove Brandt. He often visited the site, meeting with foreman Carl Sjöholm and making countless on-site modifications to the project. Bricks were used to build the walls, the shallow vaulted roof, the church floor, the altar and the pulpit. Even an opening in the brick floor is an integral part of the baptismal font. The roof of the nave rests on a central T-cross made of steel, creating a central place of worship around a detached altar.[40]

The windows in the church reflected Lewerentz's years of research on ways to reduce the number of elements surrounding the glass pane. The windows were made by pressing a 'Thermopane' panel of glass already fitted in its stainless-steel frame, onto the brick surface with mastic already in place. The window was held in place by strips of hot-dipped galvanised steel screwed to the wall. In this way, the whole perimeter of the window was completely sealed, allowing for differential expansion and protecting the corners. Cavity walls ensured good air circulation and insulation.

The British architect Peter Blundell Jones has noted how the most hierarchically important doors, for the main entrance and exits, are placed flush with the brick surface, whereas the other door frames are superposed onto the brick hole, sealed with mastic and bolted on.[41] Towards the exterior they have a

slight rough ridge and a vertical expansion slot, whereas internally they are sanded off.

Lewerentz's final years

After the death of his wife, Lewerentz spent his last years in Skåne, in an apartment rented from architect Klas Anshelm (1914-80). Lewerentz and Anshelm shared an interest in the potential of cheap materials, and Anshelm's argument was that "architecture cannot be invented".[42] Anshelm built for Lewerentz a work room of fibreboard impregnated in asphalt, creating an almost totally black atmosphere. The floor was of scrubbed wood and the ceiling was made of aluminium-faced board. Three acrylic skylights set on the diagonal provided illumination. Curiously, there were no windows in Lewerentz's working space, perhaps because they would distract his attention. In one corner, there was a door which opened onto the garden. The architect Bernt Nyberg (1927-1978) spent five intense years in those rooms, a time during which he and Lewerentz took part in competitions for the Parliament Building and a church in Växjö.[43]

During that time, Lewerentz built one of his last commissioned works, a flower kiosk at Malmö Eastern Cemetery, completed in 1969, forming part of a new entrance to the cemetery. This kiosk featured a pitched roof sheathed in copper with façades made of concrete containing three doors.

An early plan of the kiosk shows how Lewerentz initially considered using windows which overlapped the wall.[44] By using in-situ concrete for the façades he was able to create an even simpler appearance by forming a slot in which the glass panel could be positioned in the same plane as the outside surface of the wall. The glass is fixed on two sides by hot-dipped galvanised steel strips. Lewerentz briefly explained these fenestration systems: "The double-paned windows with a sealed edge have no frame and are placed directly onto the concrete walls, then fixed and sealed with special mastic".[45] Lewerentz put a considerable amount of effort into designing these window fittings, and he often drafted these windows without any kind of metal fittings. (Fig. 12) In fact, two years later, Lewerentz built the windows of new premises for the warden in the same cemetery using glass directly sealed against the wall using no metal fittings.

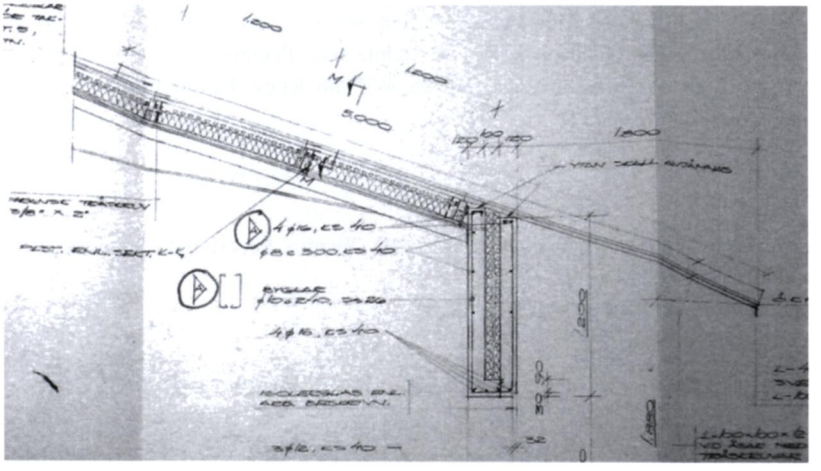

Figure 12. Flower kiosk, Malmö Eastern Cemetery, 1969. Architect: Sigurd Lewerentz. Cross section. The windows feature 'Thermopane' panels fixed by four strips of galvanized steel. Source: Stadsarkivet, Malmö.

Conclusions

This analysis shows Lewerentz's consistent rethinking and experimentation of everyday construction materials, such as bricks, mortar and glass. In time, he gradually shifted his approach to construction. Early on, his projects and production of fittings reflected an interest in novel construction methods, such as illuminated signs and industrial production, in pursuit of a visual reduction of structural frames. It was during the construction of the twin chapels of St Gertrud and St Knut built in Malmö that Lewerentz began experimenting with everyday materials, rejecting the exposure of all materials and combining glass panels with the surrounding wall to reduce the number of elements around windows.

After 1955, Lewerentz further explored the use of everyday materials and reinterpreted Swedish traditional construction methods. In doing so, he transformed conventional construction methods into alternative solutions, defining a framework of research in which rethinking the use of common materials and objects constitutes a way of innovating. Sigurd Lewerentz's construction methods also reveal a critical stance towards many of the architectural practices of his time in Sweden. His detailed construction methods reflect a viewpoint in which function, beyond the programmatic uses, also entails creating a framework for the complexities of everyday life.

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Notes and References

1. The Swedish Centre for Architecture and Design's collections, letter of S. Lewerentz to G. Ponti, 16 Aug.1963.
2. Lewerentz was awarded the Prince Eugen medallion in 1950; he was made member of the Academy of Arts in Copenhagen in 1954, appointed member of Die Bayerische Akademie der schönen Kunst in Munich in 1960, and awarded the Honorary Cube by the National Association of Swedish Architects in 1961. He was named Honorary Doctor of Technology at the Royal Institute of Technology in Stockholm in 1962, and awarded the Tessin Medallion by the Royal Academy of Liberal Arts of Stockholm, Knight Commander of the Vasa Order in 1963. See: J. Ahlin, *Sigurd Lewerentz*. Stockholm: Byggforlaget, 1987. p. 191.
3. The Swedish Centre for Architecture and Design's collections, various letters addressed to S. Lewerentz.
4. E. Rudberg, 'Building the Welfare of the Folkhemmet 1940-60' in C. Caldenby, J. Lindvall and W. Wang, (Eds.) *Sweden*. Munich: Prestel-Verlag, 1998. p. 124.
5. B. Edman, 'Sigurd Lewerentz', *Spazio & Società*, no. 23, 1983, pp. 98-105. Translation from B. Edman, 'Sigurd Lewerentz', in N. Flora, P. Giardiello and G. Postiglione, (Eds.) *Sigurd Lewerentz*, London: Phaidon Press, 2013. p. 370.
6. The Swedish Centre for Architecture and Design's collections, interview with S. Lewerentz, 8 July 1968.
7. K. Frampton, 'The Untimely Timeliness of Swedish Modernism' in L. Creagh, H. Kåberg, and B. Miller Lane, (Eds) *Modern Swedish Design*. New York: The Museum of Modern Art, 2008. pp. 15- 17.
8. P. Blundell Jones, *Gunnar Asplund*. London: Phaidon, 2006. pp. 144.
9. Edman, *Lewerentz*, (Note 5) p. 98-105.
10. Ahlin, *Sigurd Lewerentz*, (Note 2) p. 14.
11. Ahlin, *Sigurd Lewerentz*, (Note 2) p. 180.
12. W. Wang, 'Id est', *Circo,* no. 203, 2015, p. 3.
13. Ahlin, *Sigurd Lewerentz*, (Note 2) p. 106.
14. C. St John Wilson, 'Sigurd Lewerentz and the Dilemma of the Classical', *Perspecta,* no. 24, 1988, pp. 20-77.
15. W. J. R. Curtis, *Le Corbusier Ideas and Forms*. London: Phaidon, 1986. p.184.
16. S. Williams Goldhagen, 'Aalto's Embodied Rationalism' in S. Anderson, G. Fenske and D. Fixler, (Eds.) *Aalto and America*. New Haven and London: Yale University Press, 2012. p. 14.
17. C. St John Wilson, 'Aalto and the Other Tradition' in S. Anderson, G. Fenske and D. Fixler, (Eds.) *Aalto and America*, New Haven and London: Yale University Press, 2012.p. 54.
18. Sigurd Lewerentz,'Några*Architect Sigurd Lewerentz*, Stockholm: Byggförlaget, 1997. p. 136.
19. Sigurd Lewerentz, 'Modern Cemeteries: Notes on the Landscape', in N. Flora, P. Giardiello and G. Postiglione, (Eds.) *Sigurd Lewerentz*, London: Phaidon Press, 2013. p. 44.
20. E. Rudberg, 'Early Functionalism 1930-40' in C. Caldenby, J. Lindvall and W. Wang, (Eds.) *Sweden*, Munich: Prestel-Verlag, 1998. pp. 108.
21. ibid., p. 108.
22. J. M. López-Peláez, *La arquitectura de Gunnar Asplund*. Barcelona: Fundación Caja de Arquitectos, 2002. pp. 101.
23. According to Lewerentz's own description of the chapels. The Swedish Centre for Architecture and Design's collections, attachment of a letter of S. Lewerentz to Mr Aloi, 16 Jan.1948.
24. A. Smithson, 'The Landscape that can survive and the Lewerentz connection', *Spazio & Società*, no. 25, 1984, pp. 78-85.
25. The Swedish Centre for Architecture and Design's collections, letter of Lewerentz to Aloi, 16 Jan.1948. (Note 23).

26. Ahlin, 158. Grundtvig Church was originally designed by Peder Vilhelm Jensen-Klint and it was completed by his son Kaare Klint after his father death in 1930.
27. E. Rudberg, 'Building the Welfare of the Folkhemmet 1940-60', in C. Caldenby, J. Lindvall and W. Wang, (Eds.) *Sweden*. Munich: Prestel-Verlag, 1998. pp. 112.
28. ibid., p. 125.
29. ibid., p. 125.
30. ibid., p. 125.
31. Ahlin, *Sigurd Lewerentz*, (Note 2) p.152.
32. The Swedish Centre for Architecture and Design's collections, transcript of interview to Professor H. Granholm and S. Peger by J. Nauclér, for Tegelbalkar magazine.
33. Ahlin, *Sigurd Lewerentz*, (Note 2) p. 157.
34. The Swedish Centre for Architecture and Design's collections, interview to Granholm and Peger by Nauclér. (Note 33).
35. P. Blundell Jones, 'Revealing Details Lewerentz at Klippan', *Spazio & Società*, no. 53, 1991, pp. 88-97.
36. Ahlin, *Sigurd Lewerentz*, (Note 2) p. 154.
37. ibid., p. 156.
38. C. Caldenby, 'The Time of the Large Programmes 1960-75' in C. Caldenby, J. Lindvall and W. Wang, (Eds.) *Sweden*. Munich: Prestel-Verlag, 1998. pp.143.
39. Ahlin, *Sigurd Lewerentz*, (Note 2) p. 167.
40. C.H. Gustafsson, *S:t Petri Church*, Dryden Rooney, (Trans.), Klippan: Klippans kyrkostiftelse genom E. Arlock och C.H. Gustafsson, 1986.
41. Blundell Jones, 'Revealing Details', (Note 36), pp. 88-97.
42. Caldenby, 'The Time of the Large Programmes', (Note 39) p. 167.
43. B. Nyberg and K. Anshelm, 'Sigurd Lewerentz' sista boplats', *Arkitektur*, no.2, 1976, pp. 2.
44. I. Campo-Ruiz, '¿Menos o más? La construcción del kiosco de flores de Lewerentz en el cementario de Malmö', *Revista Progreso, Proyecto, Arquitectura*, No.8, 2013, pp. 132-47.
45. L. Sigurd, 'Servicebyggnad för blommor vid Scheelegatan', *Arkitektur,* no.2, 1973, pp. 5-9.