RECOVERING THE HISTORICAL CONSTRUCTION AND MATERIALS OF ERIK GUNNAR ASPLUND'S STOCKHOLM PUBLIC LIBRARY

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ABSTRACT: This work presents the first detailed study of the construction and materials of the Stockholm Public Library. As the building undergoes a rare period of maintenance and renovation, the floors and walls of the library are examined from three perspectives. First, using available but limited archival documents and plans; second, with non-destructive ground-penetrating radar measurements; and finally, through on-site surveys during local interventions for the maintenance and renovation process. The ensuing results emphasize the complementary nature of this combined research approach in recovering lost or forgotten construction details and further reveal several important findings. In the case of the unique wall finishing of the library's rotunda, multiple layers of lime mortar, each varying in thickness and coarseness, were used to build up and craft the relief-like interior wall surface. With the use of in-situ aerated concrete and prefabricated Solomite panels in the library's 1931–32 floor construction, a material connection between Asplund and the broader modern movement in architecture is further highlighted. At first glance, these construction-related findings seem to reinforce the common architectural narrative of the library as a transitional project between neoclassicism and modernism. At the same time, however, the library's separate periods of construction of 1925–28 and 1931–32 and their distinct materials can be seen as a continuity of construction culture, with the innovative use of local raw materials related to the Swedish landscape.

KEYWORDS: Asplund, architecture, heritage, renovation, ground-penetrating radar

INTRODUCTION: The Stockholm Public Library [FIGURE 01, FIGURE 02] is one of Erik Gunnar Asplund's most well-known works and holds a prominent place in twentieth-century architecture. Yet despite being frequently discussed in general architectural literature, the library's original construction and building materials have not yet been closely considered, especially in international publications (Adams, 2011, pp. 24–26; Blundell Jones, 2006, pp. 111–128; Knight, 1982; Ortelli, 2019, pp. 42–51; Wrede, 1980, pp. 100–125). Construction was nonetheless an important aspect of architecture for Asplund, as the library's construction contractor, Oscar Hegert, wrote how Asplund often visited the library's construction site early in the morning to meet with the site foreman and discuss the construction and design of the library as work progressed (Hegert & Westholm, 1956, p. 46). While working on the library, Hegert came to see Asplund as an imaginative man who still respected practical things and technical details (Hegert & Westholm, 1956, p. 46). This description echoes similar claims from Asplund's students, who described in interviews how Asplund's teaching emphasized a holistic approach, with technical issues as an important aspect of architecture (Engfors, 1990, pp.71–75). Now, as the library undergoes a rare period of maintenance (2020–24) and renovation (2025–27), there is a significant opportunity to complete timely research and for the first time, bring to light the library's historical construction and materials for a broad international audience of researchers and practitioners.

As part of an ongoing research project based at ETH Zurich, running in parallel with the library's maintenance work, this article examines the building's historical construction in three ways. First, the library's limited and incomplete construction plans and historical archived documents are presented as relevant background information. Such materials represent the typical historical

01 The exterior rotunda of the Stockholm Public Library (Stadsbiblioteket) by Erik Gunnar Asplund. © G. Löwendahl, 1938 (PDM 1.0 DEED, ArkDes Archive, Asplund Collection, ARKM.1962-101-0843).

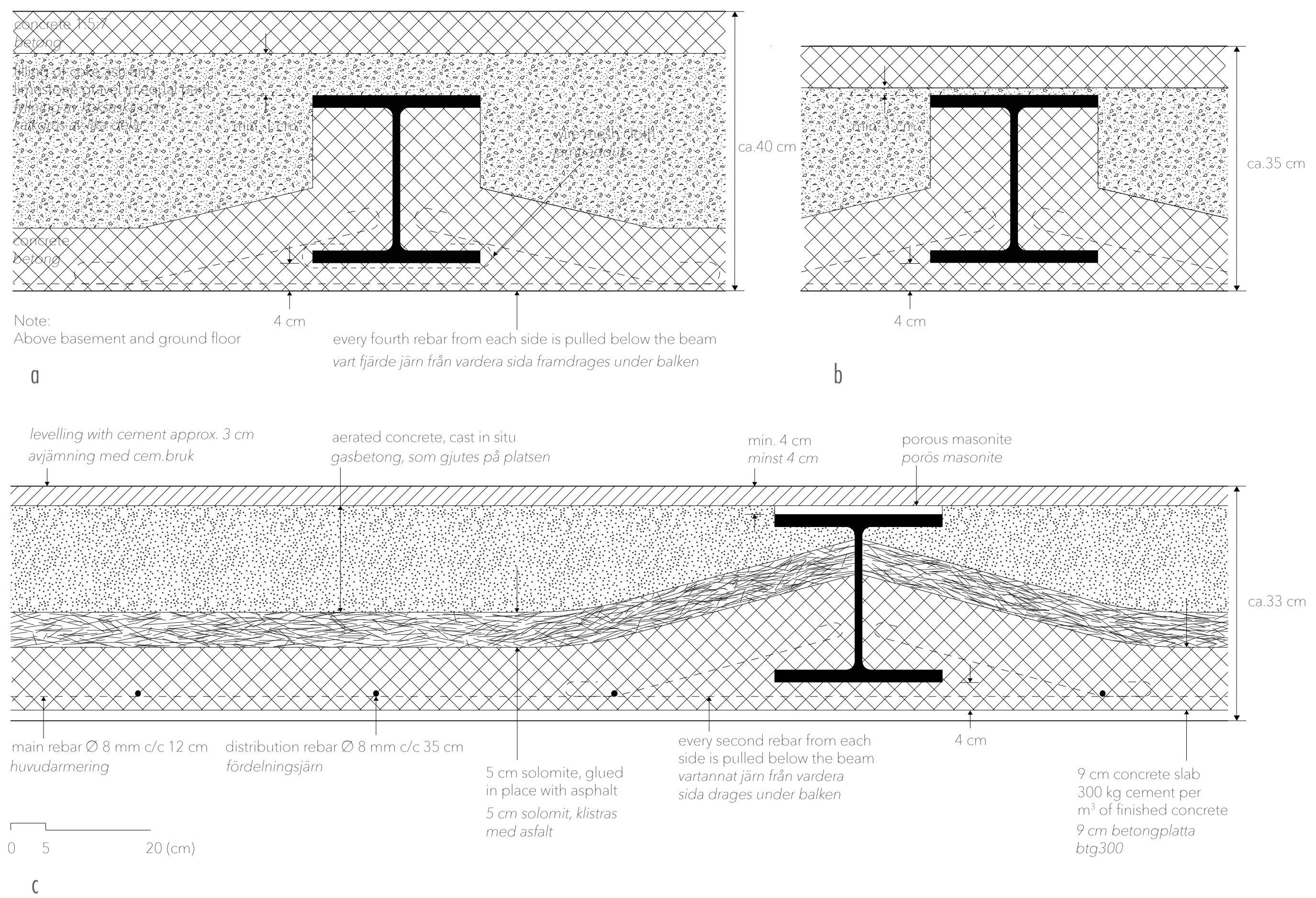
02 The interior rotunda of the Stockholm Public Library (Stadsbiblioteket) by Erik Gunnar Asplund. © P. Fleming, 2014.

materials available to both researchers and practitioners before renovation work begins. Secondly, non-destructive and non-invasive ground-penetrating radar (GPR) measurements are used to detect steel elements and estimate the thickness of various construction layers in the library's floors. These types of measurements are often helpful in gathering more specific construction details in the planning stages immediately preceding renovation work. Thirdly, on-site surveys and direct measurements of historical construction materials, performed during interventions, are used to document and finally clarify details from missing archival plans and uncertainties from GPR measurements. A subsequent discussion of the library's construction in relation to its architecture and context concludes this contribution, together with a brief summary of our main findings.

1924 BUILDING SPECIFICATIONS AND CONSTRUCTION PLANS

Archival plans and documents related to the library's original construction are significantly limited, which in part has encouraged previous studies to focus more so on the library's design rather than its construction. A recent publication by Fleming and Bergström, however, has reviewed all of the digitized and readily available archival plans for the library's design and initial construction phases (Fleming & Bergström, 2023). Their review begins with Asplund's earliest dated design from 1919, and includes a brief discussion of basic architectural construction plans for the library from September 1924, and also later updated construction plans from February and April, 1925. Complementing Asplund's straightforward architectural plans, Library Committee meeting minutes held in the Stockholm City Archives offer some insights mainly into the library's surface materials and finishes (Schönbäck, 2003).

In addition to archival plans and Library Committee meeting minutes, the KTH Library holds a special archived book simply titled, *Building Specifications* (*Arbetsbeskrivning*), describing the library's original 1920s construction process (*Arbetsbeskrivning*, 1924). This *Building Specifications* book, which was printed in 1924, does not include plans or diagrams, but rather offers 85 pages of detailed, textual descriptions of the library's planned construction details and materials.[1] For example, this historical text describes the building's main walls in masonry with a basic English cross bond, and notes how the library's floor slabs and stairs were planned to be built using a combination of steel beams and reinforced concrete (*Arbetsbeskrivning,* 1924, pp.18–22). In the chapter on concrete work, typical steel floor beams were specified with a minimum 4 cm cover of concrete underneath their lower flanges, with wire mesh folded around the beam flanges (*Arbetsbeskrivning*, 1924, p.19). Based



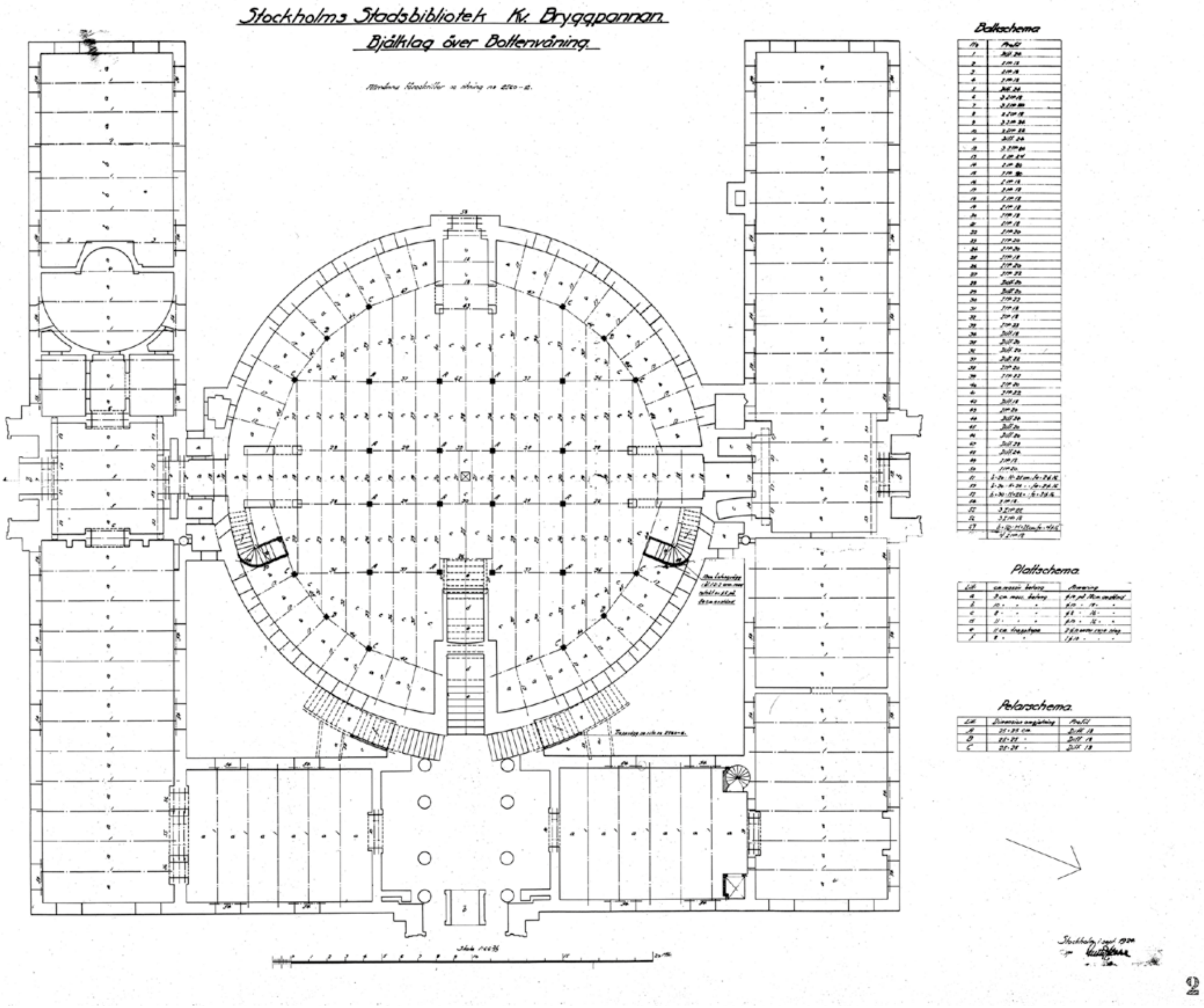
03 Floor sections of the library's original 1928 construction: (a, above left) reading room and (b, above right) upper office level, both drawn from the library's 1924 construction plans and Building Specifications text; (c, below) floor section for the western reading room, drawn from the library's 1931 construction plans. © Petronella Mill.

on subsequent text, [FIGURE 03] illustrates additional layers of the library's specified floor slab construction, including a filling of coke ash and limestone gravel, in equal parts, followed by a 6 cm subfloor poured with a relatively low-grade mixture of 1:5:7 concrete.[2] While these text-based descriptions of the library's construction can offer some important insights beyond basic construction plans, they still omit key information such as floor beam dimensions and positions, and more specific details concerning reinforcement that could have been decided spontaneously on the construction site.

As additional supplementary materials to the previous *Building Specifications* book, rare copies of six historical construction plans from September 1924 were recently discovered in the course of collaborating with planners involved in the library's ongoing maintenance work.[3] These plans were most likely created in the tendering phase of the library's construction, and have not been previously considered by architectural historians. They were also most likely revised to become a set of definitive construction plans for the library, and offer further information regarding several relevant construction details. For instance, each of the six individual plans from this set defines the positions and standard profiles of the steel beams planned throughout each floor of the library [FIGURE 04]. A normal-grade concrete mixture of 1:3:3 is further noted for reinforced concrete columns and also for the floor slabs between steel beams. Additionally, these plans illustrate a schematic section of a typical floor beam, with the beam's web poured and encased in concrete [FIGURE 03 a-b]. This section also notes a minimum concrete cover of 4 cm underneath beam flanges, with folded wire mesh around the lower flanges, closely matching the descriptions offered in the *Building Specifications* book (*Arbetsbeskrivning*, 1924, p. 19). These plans, however, provide additional construction details regarding concrete thicknesses, and reinforcement diameters and spacing; they include a table specifying 9 cm thick reinforced concrete slabs between most floor beams [FIGURE 04], where every fourth reinforcement bar in a floor slab should be pulled underneath the adjacent steel beam. Although these plans belong to the historical tendering process, and do not necessarily correspond to the actual revised construction plans that were used to build the library, they still give rare and valuable insight into a preliminary version of the library's planned construction details.

1931 DETAILED CONSTRUCTION PLANS FOR THE LIBRARY'S WESTERN WING

A set of eight detailed construction plans for the library's fourth western wing, completed slightly later in 1932, are briefly mentioned in Fleming and Bergström's recent work.[4] Their study did not closely examine the construction details of these 1931 plans and left that task for the

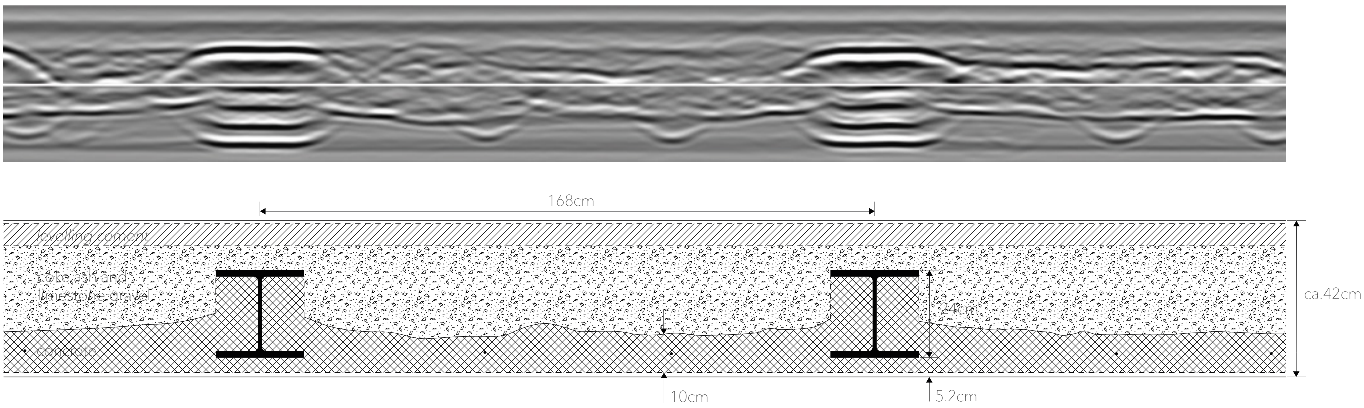


04 Digital copy of a construction plan of the Stockholm Public Library, signed by Gustaf Jilcke and dated September 1924. The plan shows floor construction details for the library's main entrance level, including floor beam locations and tables of specified beam profiles, concrete slab thicknesses, and reinforcement details. © Stockholm City Archives and courtesy of Sweco Sverige AB.

current authors to address within the more construction-focused contribution presented here. In comparison to the library's 1924 plans and written specifications, notable differences can be seen in these later 1931 construction plans. The previous coke ash and limestone gravel fill in floors are substituted with separate layers of Solomite and *gasbetong* [FIGURE 03 c]. This Solomite name refers to a specific type of construction panel made from compressed straw, whereas the latter *gasbetong* term indicates a lightweight and porous aerated concrete. Both of these construction materials were only patented and began to be produced industrially in the 1920s (Neuberger & Kic, 2021; Schramm, 2008). The replacement of more conventional, heavier construction materials with newer, lighter alternatives like Solomite and aerated concrete was most likely driven by various issues related to structure, economics, and acoustics as discussed in more detail later on. For now, however, it is important to acknowledge both the helpful insights and limitations that typical archival materials can offer renovation practitioners and researchers alike. These historical documents, although incomplete and often lacking specific construction details, can still serve as a valuable guide for identifying key issues and areas for more detailed investigations. Such documents further establish a basic expectation and reference when measuring a building's historical construction in a non-destructive manner or later during definite interventions performed in the course of renovation and maintenance efforts.

GROUND-PENETRATING RADAR (GPR) SCANNING

Ground-penetrating radar (GPR) is a well-established technique for investigating not only geological features, but also existing concrete and masonry structures (Lai, Dérobert, & Annan, 2018). Due to the ability of radar waves to propagate through concrete, yet reflect off of steel reinforcements or pipes, the GPR technique is well suited for identifying internal construction details in a simple and non-invasive manner. Furthermore, if the relative dielectric permittivity constant of a material is approximately known, GPR can also be used to estimate construction layer thicknesses based on simple calculations using the radar's wave speed (Bigman, 2018). While contemporary hand-held GPR devices have become more portable



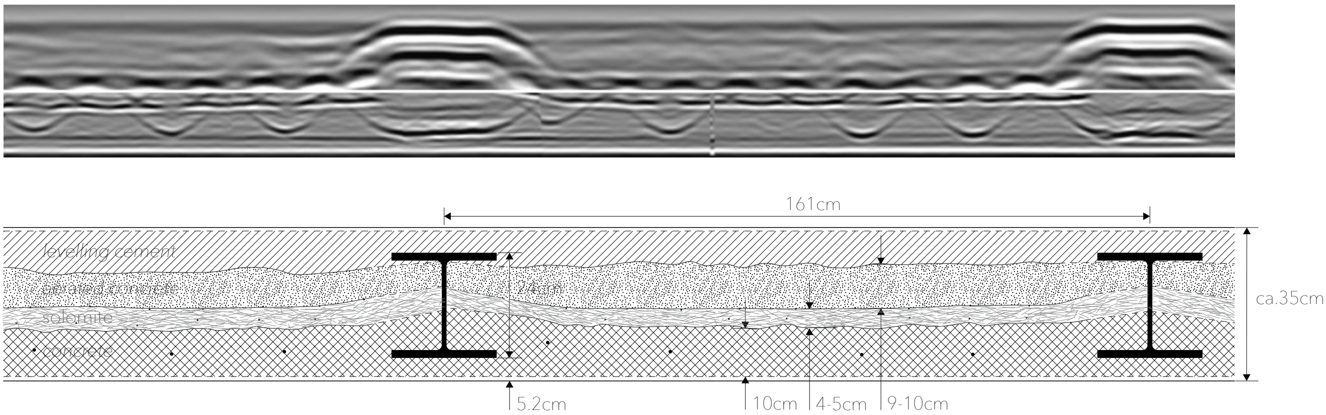
05 Representative GPR measurement examples (above) of the 1928 southern reading room floor and children's library ceiling on the library's main entrance level, and the corresponding floor section (below) interpreted directly from the GPR measurements. The total floor section depth of 42cm was measured directly from the authors' 3D point cloud model of the entire library. © Patrick Fleming.

and easier to use, the interpretation of measurement data remains as a key issue, especially when considering relatively complex cases of historical construction.

READING ROOM FLOORS AND CEILING

GPR scanning was coordinated at the Stockholm Public Library in November 2021 and June 2022 with Northscan AB.[5] The floors of all the library's reading rooms were scanned first to determine the location of steel beams. In each reading room, two parallel lines of scans were performed along the entire length of the room. [FIGURE 05] shows an illustrative measurement example where the beam locations and spacing can be estimated directly from the measured GPR data. To better understand the library's original 1925–1928 floor construction, the ceiling directly underneath the southern reading room was additionally scanned. These scans from below could be used to estimate the thickness of the lower layer of reinforced concrete in the reading room's floor slab, thereby complementing the previous scans on the floor above. From the representative measurement shown in [FIGURE 05], the lower concrete slab thickness is estimated to be about 10 cm from the GPR measurements, when a typical value of 5 is taken for the relative dielectric permittivity constant of concrete (Bigman, 2018, p. 28). Furthermore, the measurements yield a distance of about 5.2 cm from the underside of the lower beam flanges to the underside of the finished ceiling. Assuming a thickness of roughly 1 cm of render for the finished ceiling, the resultant concrete cover thickness estimate of about 4.2 cm from GPR measurements agrees fairly well with the 4 cm cover thickness noted in the library's 1924 construction plans and *Building Specifications* (*Arbetsbeskrivning*, 1924, p. 19). Similar agreement can be seen between GPR measurements and the 1924 construction plans for the typical center-to-center beam spacing of approximately 165 cm in the southern reading room's floor. These results indicate that the overall structural concepts and construction principles seen in early construction plans were not significantly altered or updated before or during the library's construction process. These initial measurements further demonstrate the overall usefulness of the GPR technique for determining the basic locations of steel elements and estimating concrete thicknesses. While the slightly sloping upper concrete surface directly next to the beams can be discerned from the GPR data [FIGURE 05], the measurements do not offer a sufficient resolution or a level of detail to determine if the webs of the floor beams have been encased in concrete. Here, we find both the usefulness of such GPR measurements and their limitations in terms of accuracy and detail.

Similar to the previous case with the 1928 southern reading room, additional GPR measurements were performed on the ceiling of the library's western reading room built in 1932 [FIGURE 06]. These measurements confirmed a more complex and layered form of construction when compared to the library's earlier areas from 1928. To check the accuracy of the 1931 construction plans for the library's western wing, the reading room ceiling was again scanned first from above, or on the floor in the office directly above the reading room, and then later from below using a ladder positioned on the reading room's upper gallery level. Both of these GPR measurements, from above and below the western reading room ceiling, showed the expected multilayered floor slab, as indicated in the 1931 construction plans [FIGURE 03 c]. Assuming a finished ceiling thickness of roughly 1 cm, and taking an overall value of 5 for the relative dielectric permittivity constant for the entire floor slab, the thickness of each layer in the floor construction could be roughly estimated: approximately 10 cm for the lower reinforced concrete slab, 4–5 cm for the Solomite layer of compressed straw, and about 9–10 cm for the aerated concrete layer. This estimated thickness for the aerated concrete is noticeably lower than the 14 cm expected from the relevant construction plan [FIGURE 03 c] and may be strongly influenced by the assumed relative dielectric permittivity constant. Furthermore, these GPR measurement data also suggest that additional steel reinforcement is located directly in the floor's Solomite layer, as shown in [FIGURE 06]. This result was unexpected when compared to the relevant construction plan [FIGURE 03 c]; steel reinforcement was only expected to be present in the floor's lower layer of reinforced concrete.



06 Representative GPR measurement example (above) of the 1932 western reading room floor and corresponding ceiling located directly underneath the reading room on the library's main entrance level, and the corresponding floor section (below) interpreted directly from the GPR measurement. The total floor section depth of 35cm was measured directly from the authors' 3D point cloud model of the entire library. © Patrick Fleming.

With a planned intervention directly in the floor above this reading room ceiling area, such uncertainties need to be clarified through later on-site surveys and manual measurements.

ON-SITE SURVEYS FROM CURRENT MAINTENANCE PROJECT

To clarify the noted uncertainties from archival plans and documents and the previous GPR measurements, direct measurements of the library's historical construction and structures were coordinated alongside ongoing maintenance and renovation work. Between February and May 2022, two specific areas of the library building were measured and documented as they were subjected to major, yet rather localized interventions: first, an area of the floor from the building's uppermost office storey (Level 600), located directly above the western reading room from 1932; and second, the original wall of the main rotunda [FIGURE 02], where two existing shafts running up the entire height of the space were opened and exposed in the process of replacing various lengths of piping. Although the rotunda walls were not originally planned to be examined within the scope of this study, the unique and crafted texturing of their interior surfaces [FIGURE 02], overall architectural importance, and the unavoidable destructive nature of the corresponding interventions merited special attention and documentation efforts. All on-site measurements were made using a basic ruler or callipers with accuracies of 1 mm and 0.1 mm, respectively. Compared to these relatively low error estimates, more significant uncertainty in on-site measurements was also expected due to the uneven surfaces of the historical construction materials involved. Where possible, measurements were made from an average, representative location of the overall surface in question.

LEVEL 600 FLOORS

While replacing the original piping embedded in the Level 600 floor of the library's 1932 western wing, the stratification of the floor construction and materials was immediately revealed. As suggested in the previous 1931 construction plans and derived from non-destructive GPR measurements, the floor displayed steel beams with a multi-layered construction, including layers of reinforced concrete, Solomite, and aerated concrete [FIGURE 07]. Starting with the floor's exposed steel beam, the top flange had an overall width of 240 mm and a thickness of 18 mm. As the beam's lower flange was embedded in the floor's lower-most layer of reinforced concrete, the overall height of the beam profile could not be determined. Nonetheless, the beam's measured flange width and thickness correspond precisely to the historical standard 'Dip24' profile noted in the 1931 construction plans [FIGURE 03 c] (Swedish Institute of Steel Construction, 2020).

Solomite and aerated concrete layers were laid and poured, respectively, on top of the lower slab of reinforced

07 The local intervention and exposed layers of Solomite and aerated concrete materials in the library's uppermost floor in the 1932 western wing. © Marcelo Rovira Torres, 2022.

concrete [FIGURE 07]. The layer of Solomite measured approximately 50-60 mm thick, and being made of compressed straw, had a rather dry and brittle quality. The intervention process further revealed how the Solomite layer was originally manufactured with wire mesh to bundle and restrain the cross-section of compressed straw. It was precisely this steel mesh that was detected and noted as an unexpected result in the previous GPR measurements [FIGURE 06]. A more thorough review of the original French patents related to Solomite and its production further confirmed how such steel mesh was originally specified in the product's first 1922 patent by its inventor, Serge Tchayeff (Tchayeff, 1922). While Solomite has been discussed in previous literature more so as a thermal insulation material, it is important to note that Tchayeff also received a subsequent French patent in 1925 for using Solomite to construct 'sound-proof' floors (*Construction de planchers insonores*) (Raytchine, Boumier, & Tchayeff, 1925). As this ceiling above the western reading room is an internal structure, with a storey of offices directly above, the use of Solomite here was certainly for acoustical reasons rather than thermal issues. The actual acoustic insulation performance of this historical construction remains an open issue to address in future work and a forthcoming publication.

Directly above the Solomite, the layer of aerated concrete measured approximately 9–10 cm thick. This thickness is notably less than the expected 14 cm of aerated concrete indicated in the 1931 construction plans [FIGURE 03 c]. With less aerated concrete poured on site, the actual floor construction displayed a much thicker layer of levelling cement directly above the aerated concrete. Compared to the ideally smooth surfaces of the aerated concrete drawn in the section of the construction plans [FIGURE 03 c], the actual historic material on-site featured a rather rough, uneven upper surface [FIGURE 07]. Upon closer inspection, the cross-section of this aerated concrete layer also had a porous, almost volcanic stone-like quality, and appeared to be slightly denser at the bottom than at the top of the section. Shrinkage and variations in the surface and materiality of historical aerated concrete were expected when considering the cast-in-situ process and extended curing time of the material. As noted in Axel Eriksson's 1923 American patent for producing aerated concrete, warm water could be used to speed up the chemical reactions during on-site curing of the aerated concrete, and workers on the library site in 1931–32 most likely followed this process (Eriksson, 1931). With Eriksson's subsequent patented development of autoclaved aerated concrete only a few years later in Stockholm, which has been well documented in both German and English literature (Hellers & Schmidt, 2011; Rychner, 1952; Schramm, 2008), far more uniform and smooth prefabricated panels could be produced.[6] This study, however, brings to light for the first time how the library's 1931-32 construction was a relatively early and notable example of construction with an in-situ type of aerated concrete.

After collecting a small physical sample of the library's aerated concrete during the intervention process, straightforward mass and volume estimates reveal its density to be approximately 800–900 kg/m^3. This estimate is slightly higher than the typical density of 700 kg/m^3 that is quoted in Swedish literature on the early production of cast-in-situ and air-cured aerated concrete in the 1920s and early 1930s (*Skövde Gasbetong Aktiebolag*, 1948, p.20). Yet in comparison to the more conventional 50/50 fill mixture of coke ash and lime gravel described for the library's original 1925–28 floor construction, with typical densities of 700 kg/m^3 and 1200 kg/m^3, respectively, only a marginal reduction in self-weight would have been achieved with the use of Solomite and aerated concrete in the later 1931–32 construction period. The steel floor beam profiles and spacing from both construction periods similarly remained unchanged, suggesting that the switch from conventional coke ash and lime gravel to Solomite and aerated concrete was not motivated by structural reasons, such as reducing the self-weight of the floor section. Economic and acoustic factors cannot be ruled out, however, and remain as topics for future studies.

ROTUNDA WALLS

During another intervention in the summer of 2022, the perimeter wall in the northwest area of the rotunda was cut partially through, which provided access to existing mechanical shafts while also exposing the construction of the wall in detail. With the shafts open, the original 1928 construction and unique texturing of the rotunda wall were revealed. As the rotunda's finished wall texture was never described or illustrated in any available literature or construction drawings or even mentioned in the archived meeting minutes between Asplund and the Library Committee, its construction has never been documented or well understood. The wall's interior texturing, however, may have been intended to influence the natural lighting and acoustics of the main rotunda. As commonly seen in contemporary photographs of the library, this uniquely crafted and relief-like texturing of the rotunda wall [FIGURE 02] plays an important role in emphasizing the materiality of the library's interior architecture and construction.

The intervention process revealed how the rotunda wall's finish texture was rendered with multiple layers of lime-mortar with significant variations in thicknesses [FIGURE 08]. The rendered layers were applied directly on to the masonry of the curved rotunda wall, without any

08 The rotunda wall intervention provided access to existing pipes for renovation purposes, while also revealing the wall construction and multiple layers of the wall's unique rendered texturing for research purposes. © Marcelo Rovira Torres, 2022.

additional protruding substrate. The first layer, acting as a parge coat, consists of a coarser render supported by a thin metal mesh with a grid of 20x20 mm. Because the parge coat was primarily used to even out the irregularities of the main brick wall, its thickness varies from several centimetres to being practically omitted in some places. The second layer is of a finer grain than the parge coat and again varies in thickness [FIGURE 08], from a few millimetres to approximately 30 mm. Before finishing with a basic layer of paint or lime wash, this second layer was effectively built up or thickened in localized areas to give a subtle depth to the wall's finish and texturing. Hence, by varying the thickness of the individual layers of the rotunda wall's rendering, the irregular and crafted texture of the rotunda wall was achieved.

In addition to the interior wall finishing, the shaft intervention process further revealed that the rotunda's upper clerestory section of masonry walls rests on a reinforced concrete ring beam [FIGURE 08]. Historic meeting minutes between Asplund and the Library Committee note how the overall thickness of the rotunda's upper masonry walls was reduced for economic purposes. The presence of an in-situ reinforced concrete beam, however, was not expected from previous literature or archival documents. The extended width of this ring beam projects inwards over the lower part of the rotunda wall, creating a narrow walkway used for maintenance purposes, such as cleaning the upper rotunda windows and accessing the roof space above the ceiling. At the same time, this reinforced concrete ring beam most likely serves a structural role in redistributing the self-weight of the upper walls, thereby reducing any eccentric loading on the lower supporting walls. As Asplund opted for a smooth transition between the lower rotunda wall surface and the inclined edge of the protruding concrete beam [FIGURE 08], the lime-mortar layers gently curve inwards, away from the masonry. The layers then meet and follow the inclined edge of the ring beam, creating a cavity in the wall. To support this suspended area away from the masonry, a steel mesh, bound to a 12 mm rebar grid structure, was used in the first parge coat layer of lime mortar [FIGURE 08]. The 12 mm rebar grid was attached with nails to the masonry wall below and to the inner inclined edge of the concrete beam above. In this suspended area, the lime mortar layers were generally thicker than in the rest of the wall, most likely to accommodate larger tolerances.

DISCUSSION AND CONCLUSIONS

Since the time of its opening, the library has been the subject of significant architectural debate, involving a broader transition from 1920s Swedish neoclassicism to mainstream functionalist design after the Stockholm Exhibition of 1930 (Åhrén, 1928; Asplund, 1928;

Caldenby, Lindvall, & Wang, 1998, pp. 72–74). In terms of construction, the markedly different materials observed in the library's 1925–28 and 1931–32 construction periods at first glance seem to reinforce such a transition narrative surrounding the library's architecture. The use of Solomite and aerated concrete from the latter period similarly reflects the commonly noted architectural differences between the original 1928 library reading rooms and the later 1932 reading room of the library's western wing (Ortelli, 2019, p. 49; Schönbäck, 2003, pp. 62–65). Solomite, in particular, is described in architectural literature as a modern thermal insulation material, used most notably by Le Corbusier in the influential l'Esprit Nouveau pavilion built for the Paris International Exhibition of 1925 (Neuberger & Kic, 2021; Rüegg, 2016, pp. 36–37). While Asplund's inaugural KTH lecture in 1931 acknowledged Le Corbusier's theoretical influence (Asplund, 2001), we can now see a practical material connection between Le Corbusier and Asplund with the use of Solomite in the floors of the library's 1932 western wing. This material connection was undoubtedly made via Uno Åhrén and his use of Solomite in a 1930 Stockholm Exhibition demonstration house (Rudberg, 1999, p. 156). Likewise, the use of aerated concrete in the library's later western wing contrasts with the more conventional coke ash and lime gravel from the building's original 1920s construction. Asplund apparently used 'modern' and recently developed, patented materials in the library's western wing to realize a modern, 'functionalist' architecture.

But upon closer consideration of both Solomite and aerated concrete, we can see two construction materials that are not simply 'modern' per se, but quite strongly connected to the Swedish landscape and a longer tradition of construction. For instance, the Stockholm-based company Lyrholm & Videgård were most likely responsible for supplying the library's Solomite panels, based on their previous supply of Solomite panels in the 1930 Stockholm Exhibition (Rudberg, 1999, p. 156). They also registered the term 'Solomite' as a protected trademark in July 1930 for panels produced near Norrköping using straw harvested from seven local farms around 160 km southwest of Stockholm (Jordbruksdepartementet, 1939, p. 29). Similarly, the raw materials needed to develop and produce aerated concrete come directly from the geology and stratigraphy of layers in the ground around the area of Skövde, located about 300km southwest of Stockholm (Rychner, 1952; *Skövde Gasbetong Aktiebolag*, 1948). It is no coincidence that this region was also home to the earliest commercial production of aerated concrete in Sweden. While the development of aerated concrete is often traced back to the mid-1920s with Axel Eriksson's patents, the material's key raw ingredients of Ordovician limestone (*Ortocerkalk*) and alum shale (*alunskiffer*) were strongly related to the landscape and geology of Sweden (*Skövde Gasbetong Aktiebolag*, 1948). The distinct use of these construction materials in the library's 1932 western wing was therefore not necessarily a modernist break with neoclassicism and architectural tradition but more so a continuation of construction culture in the form of recent innovations using regional raw materials.

Many of the original findings presented in this article are a direct consequence of being able to follow the library's current maintenance process and interventions as non-biased observers. The results of this work illustrate how researching buildings during a renovation period leads to meaningful insights and new knowledge. Although many serendipitous findings can also arise, such novel discoveries often remain undocumented and rarely disseminated to future generations of researchers and practitioners. In this regard, general policies from cities or institutions to encourage research activities during the renovation of important heritage buildings would be a positive step forward in the future. However, renovation projects are usually limited in their time and funds and unable to finance research work related to broader matters of architectural history and historical construction. Government-supported research councils and foundations can play a crucial supportive role here, but it is first up to researchers to develop innovative and useful bottom-up proposals to allow studies to be carried out in parallel and in collaboration with practitioners and planners.

Based on archival documents, non-destructive GPR measurements, and surveys during the library's current ongoing maintenance and renovation, the present study has recovered original construction details and materials of the Stockholm Public Library. This work highlights the library's steel and reinforced concrete floor construction from 1925–28, in contrast to the second construction period of 1931–32, with the library's fourth western wing with floors of steel and reinforced concrete, Solomite, and aerated concrete. The construction of the rotunda walls was further investigated and documented in parallel with interventions, showing for the first time how the wall's unique and crafted texturing was built up using varying layers of lime mortar. These discoveries emphasize the library's construction in terms of both conventional and innovative materials and establish links and material connections between the library and other well-known works of architecture and design. This work further underscores the benefits of conducting academic research in parallel with practical renovation efforts, leading to more in-depth research questions for future studies involving the library's historical acoustics and interiors.

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ENDNOTES

1 A printed book version of a project's building specifications was standard practice in Sweden during Asplund's time.

2 Following historical construction standards, a 1:5:7 concrete mixture would denote a concrete mixture of 1 part cement, 5 parts sand, and 7 parts coarse material. See (*Arbetsbeskrivning*, 1924, p. 20).

3 GUNNARSSON, E., Sweco Sverige AB, personal communication, 17 March, 2022.

4 There are two sets of the library's 1931 construction plans available in the online ArkDes archive. Both sets are dated May, 1931 and drawn by Stig Ödeen, an engineer associated with Asplund's later projects. Like the 1924 construction plans, one set of the 1931 construction plans are signed by Gustaf Jilcke, who was Henrik Kreüger's business partner. The other set of 1931 plans are simply stamped by Henrik Kreüger's Consulting Engineers Office. See (Fleming & Bergström, 2023).

5 Northscan AB is a company located near Stockholm and offers a range of non-destructive testing services.

6 For an overview of Johan Axel Eriksson's development of aerated concrete, from an initial mixture of ingredients, to a detailed manufacturing process involving air curing, and finally, to an improved process with pressurized steam curing, see the following original Swedish patents, respectively: ERIKSSON, J.A. (1922). *Sätt att framställa cement.* (Swedish Patent No. 51193). Kungl. Patent- och registreringsverket.; ERIKSSON, J.A. (1926). *Förfaringssätt för framställning av gasbetong.* (Swedish Patent No. 60995). Kungl. Patent- och registreringsverket.; ERIKSSON, J.A. (1926). *Förfaringssätt för framställning av gasbetong* (Swedish Patent No. 60091). Kungl. Patent- och registreringsverket.