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# RE-LEARNING SIGURD LEWERENTZ: AN APPLIED HISTORY OF THE CHURCH OF ST. PETER'S IN KLIPPAN, SWEDEN

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## Keywords

On-Site Design, Re-Construction, Sigurd Lewerentz, Masonry, Craft, Descriptive Geometry

## Abstract

Sigurd Lewerentz, one of the great Swedish architects of the 20<sup>th</sup> century, distinguished himself through his playful mastery of masonry construction; most notably in his 1962 Church of St. Peter's in Klippan, Sweden. Despite being revered for his novel approach towards material assembly, there remains a void in the historical understanding of Lewerentz's construction methods given the works were largely manifested through a process of on-site management and design, rather than through drawings alone. The built artifacts possess traces of this knowledge, but it is possible to fill historical voids and contribute to a comprehensive understanding of Lewerentz's construction practices through the physical reproduction of his works. This paper proposes a method of scaled-construction whereby researchers re-create specific masonry techniques, using photographs, dimensional drawings, and historical accounts, to resurrect knowledge currently trapped within the brick. Through this method, the logic of certain geometric operations and patterns emerge. The process unearths critical insight into the unique reciprocity between thinking and making in Lewerentz's work. What begins as a void becomes an opportunity for engaging the physical processes that define the architect's contribution. This paper employs a method of knowledge extraction through physical making, which has the potential to flesh out a better collective understanding of Sigurd Lewerentz's work as well as an application to better understand the works of other master architect/builders, whose techniques demand some form of action to bring them to light.

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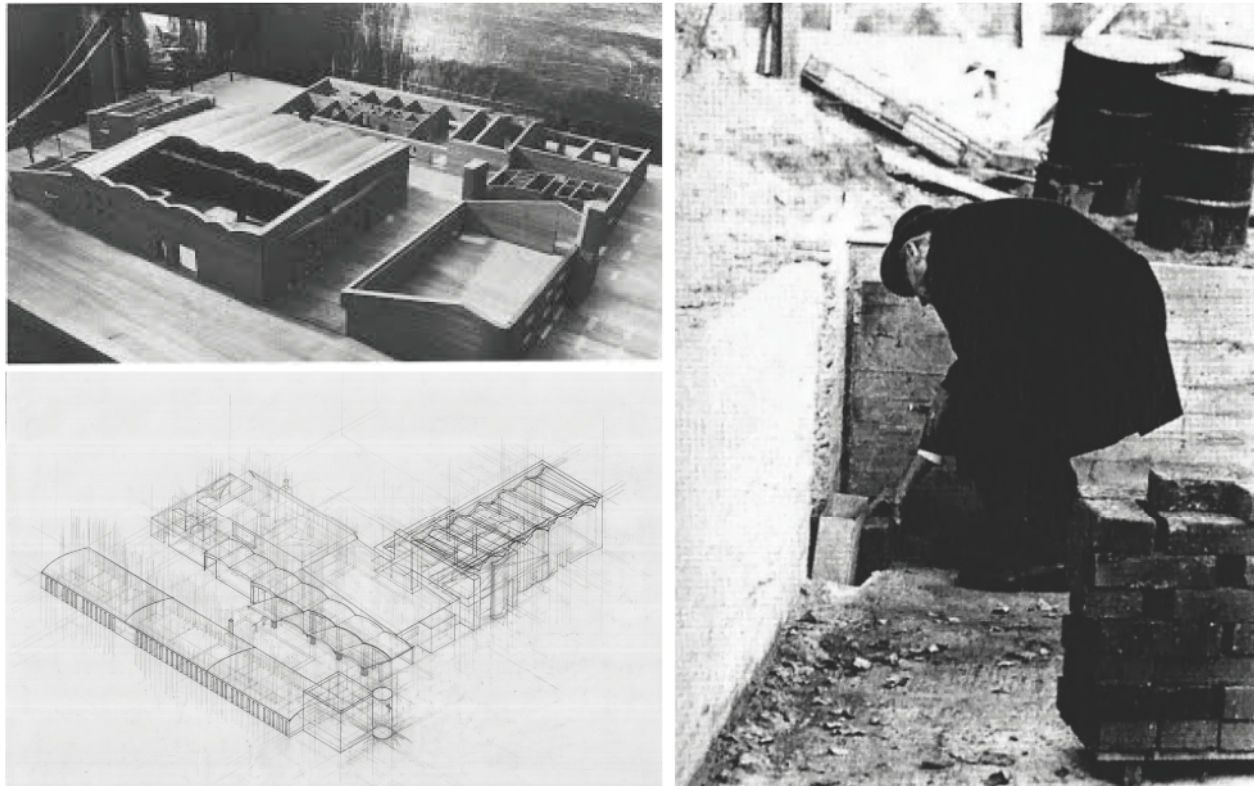


Figure 1: Representation-based historical analyses compared with the reality of on-site design. Top left: Model of St. Peter's Church, produced by students from GSD, 1989; Bottom left: Analytical drawing by RISD student, 2013; Right: Sigurd Lewerentz on site in Klippan, inspecting the brickwork at St. Peter's Church, 1963

## INTRODUCTION

Sigurd Lewerentz is idolized by many in the architectural field for his built works in Sweden; however, he remains historically elusive. "The literature on Lewerentz," as described by historian Claes Caldenby, is "remarkably limited." Caldenby cites Janne Ahlin's book, 'Sigurd Lewerentz, Architect', as being the most significant account of the architect's work, but suggests that, aside from this source, "not much has been published." (Caldenby 1997) Much of what has been written about Lewerentz—born 1885 in Sandö, Sweden—is either narrative-based or descriptive about the affects produced by his architecture: "The relative muteness of [St. Peter's] exterior and the darkness of the interior reinforce the 'all over' and intensely spatial character of the building's physical condition." (Caruso 1997) Attempts at documenting the architect's design process have been largely anecdotal to this point, with a few exceptions. Students at the Rhode Island School of Design have produced detailed hand-drawings of St. Mark's Church, while another group at Harvard University's Graduate School of Design built a scale model of St. Peter's Church. (Fig. 1) While these drawings and wooden models contribute to a more thorough documentation of Lewerentz's work, they prioritize dimension and form rather than engaging the methods and materiality for which Lewerentz has become renowned. This paper identifies value in the conflation between thinking and making in Lewerentz's work and posits that, in order to resurrect knowledge currently trapped within the brick, one must engage the architect's work through method. The following outlines a way to begin reconciling this historical void through a process of re-construction.

The contradictory notion of fame and historical void are the result of Lewerentz's approach to design and building, specifically his natural fixation towards on-site design. (Fig. 1) In his seminal work of 1987, Janne Ahlin argues that Lewerentz's drawings were a constantly evolving "story" that lacked legibility: "Many revisions and explanatory drawings reached the contractor's office. They were not easy to understand, and Lewerentz had to instruct further as to how they were to be read." According to Ahlin, "His radicalness lay instead in the many surprising ways in which he handled the task of building." (Ahlin 1987) For Lewerentz, buildings are conceived less through prescribed measures, such as comprehensive drawing sets, and instead evolve through a more fluid exchange between the architect and his builders. He "spent many long evenings" with his foreman, Carl Sjöholm, "planning out the work for the following day," and he approached the construction site as conceptually-fertile ground: "During his many intensive visits to the job site, Lewerentz found new and surprising solutions to problems." (Ibid.) Within this process, Lewerentz uses drawing to frame a method-based process of experimentation rather than to assert an abstract and conclusive representation of architectural intent. "When construction started," at St. Peter's, for example, "only a few sketches existed which mainly gave the building's measurements and locations." (Ibid.) The anticipation for change is necessarily built into Lewerentz's drawings and, as a result, they are largely devoid of critical details that assert how the building was constructed. The initial set of 1:50 drawings that guided the construction at St. Peter's for the first two full years (January 1963 – March 1965) do not have a single brick penciled-in and even the subsequent set of 1:20 drawings (February 1965 – September 1965) differ substantially between brick drawn and brick laid. (Fig. 2,3)

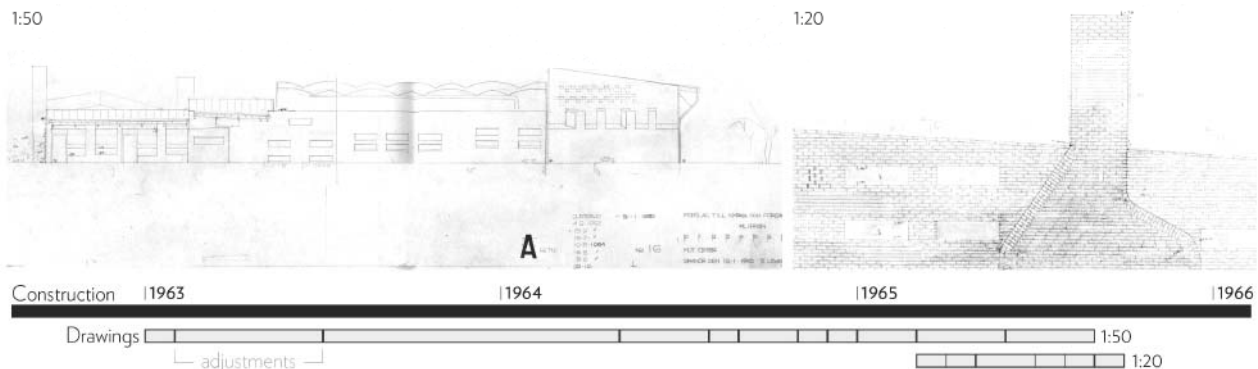


Figure 2: Timeline showing the unique relationship between drawing and construction at St. Peter's Church. The drawings were constantly adjusted throughout the entirety of the building's construction

While Sigurd Lewerentz's priority of process over definitive drawing appears unique, it is not the only example. Architects such as Filippo Brunelleschi of the 15th century and Philibert de l'Orme of the 16th century are but two that exist in this lineage, both emerging into the profession of architecture through trades. Each of these individuals is invested in developing techniques that merge the process of design with the process of making. For example, the attribution of the Duomo to Brunelleschi is largely due to his continual presence at the jobsite. (Fanelli 2004) In his printed work of 1567, 'Le premier tome de l'architecture', De l'Orme introduces the method of art de trait géométrique. Robin Evans describes this technique in his text, 'Drawn Stone', as a way to employ projective geometry in order to develop formal inventions. (Evans 1995) 'Traits' are full-scale templates that masons wrap around stones in order to precisely carve the unique units of construction. For De L'Orme, as with many of these master-makers, the act of drawing is intrinsically connected to the means and methods of production. Despite a past that



is saturated with master-makers, their techniques often reject a more conventional, document-driven history. In the case of Sigurd Lewerentz, that which distinguishes the architect also obscures our understanding of his work. How can we clarify these rich histories?

## METHOD

This paper describes a specific form of research where historical construction processes are engaged and revealed through the physical replication of method and form. When confronting a gap in the historical record of such techniques, the exercise is admittedly projective, but it offers the potential to mine alternative knowledge. Most buildings possess some fragmented clues into their construction, whether these exist within the structures themselves, the drawings, or the written history, but these pieces become lucid when they are consolidated in a critical manner. To take this archival approach one step further, we can use the alignment of these fragmented clues as a basis for physically reconstructing elements of a building, at different scales, to prototype against material and gravitational forces. Re-construction is therefore a process of piecing together existing histories in addition to being a physical hypothesis on the means and methods of material assembly. The application of this process is essential to our production of a more comprehensive history of construction and re-frames historical voids, not as an insurmountable problem, but rather an exciting opportunity for deeper engagement and discovery.

### Case Study: St. Peter's Church

This paper selects Lewerentz's St. Peter's Church as a case study with focused prototypes of the parish chimney and the chapel's vaulted ceiling. Both prototypes grow out of a composite analysis of the existing drawings and photographs of the building. Much like the actual construction of the church, the drawings are useful in that they articulate a general geometric framework for the models, but they stop short of proposing a methodology for their making. Both the chimney and the vault have orthographic information, but the amount of detail within these drawings differs quite substantially. The chimney is drawn at 1:20 scale and gives an approximation of the discrete masonry elements, whereas the vault appears to have been conceived of earlier and is only represented in the initial 1:50 drawing set. As a result, the vaulted ceiling lacks any descriptive reference to the brickwork and, thus, poses a different set of reconstruction challenges. In both instances, photographs of St. Peter's, taken after its construction, provide crucial information about how the drawings were translated in the field. Through these images, discrepancies emerge between the drawings and the physical manifestation. (Fig. 3)

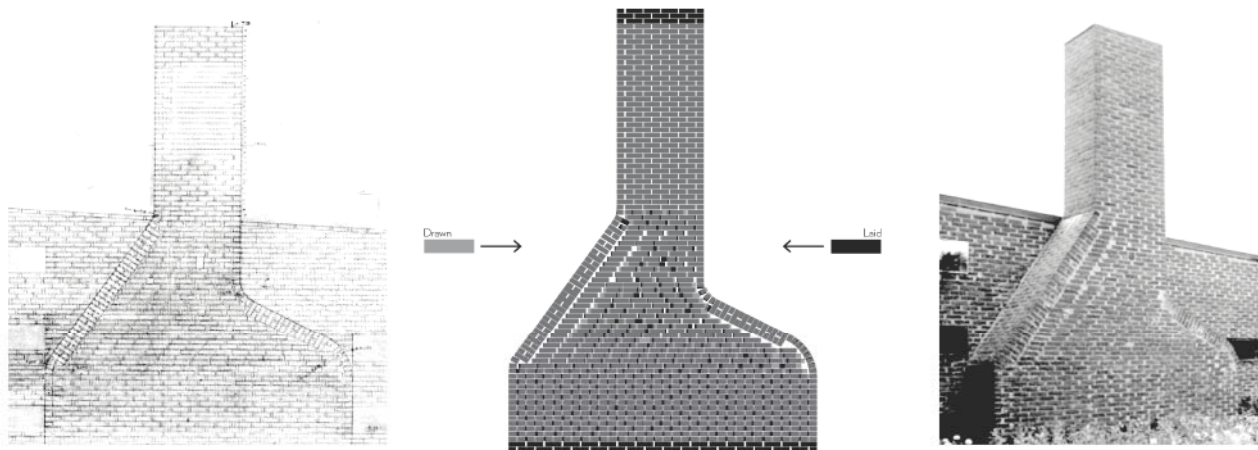


Figure 3: Comparative analysis between brick drawn and brick laid in St. Peter's chimney

## Scale

Both prototypes are constructed at a scale of 1:4 because it provides a balance between the sizing of the bricks and the resultant global dimensions of the chimney and the vault. Initial attempts made at 1:10 scale proved insufficient across multiple categories. At this scale, the bricks lack porosity and the viscosity of the mortar is too dense to serve as a proper scale analog. Additionally, the bricks are too small for hands to manage. At 1:4 scale, the bricks are 2-1/4" (L) x 1-1/16" (W) x 0-9/16" (H) and strike a balance between the speed of the prototype re-constructions and the productive simulation of a full-scale analog.

## Material

The bricks are made of Quikrete's Fast Setting Concrete Mix (No. 1004), which consists of cement, sand, and gravel, and sets within 20-40 minutes. The standard blend is modified slightly by sifting out all of the large gravel elements that conflicted with our desired scale. The 1:4 Quikrete bricks are satisfactory in their approximation of the weight and texture of full-scale bricks. We cast these bricks in batches of 100 using silicone rubber molds that offer the benefit of re-use. The mortar is a cement-based tile grout called Polyblend. The acrylic-binder within this product renders it easy to use, without compromising critical properties of stiffness and strength. Unfortunately, not all material properties can be scaled accurately and they are inevitably loose approximations; however, this paper exhibits that the exercise is capable of producing insight into the construction syntax and conceptual strategies that help bring these historically significant buildings into the physical world.

## Logic

One of the foundational principles for the construction at St. Peter's is that "no brick was to be cut." (Ahlin 1987) This logic feeds the unconventional challenges and solutions found in Lewerentz's work and it was strictly obeyed in the construction of both prototypes.

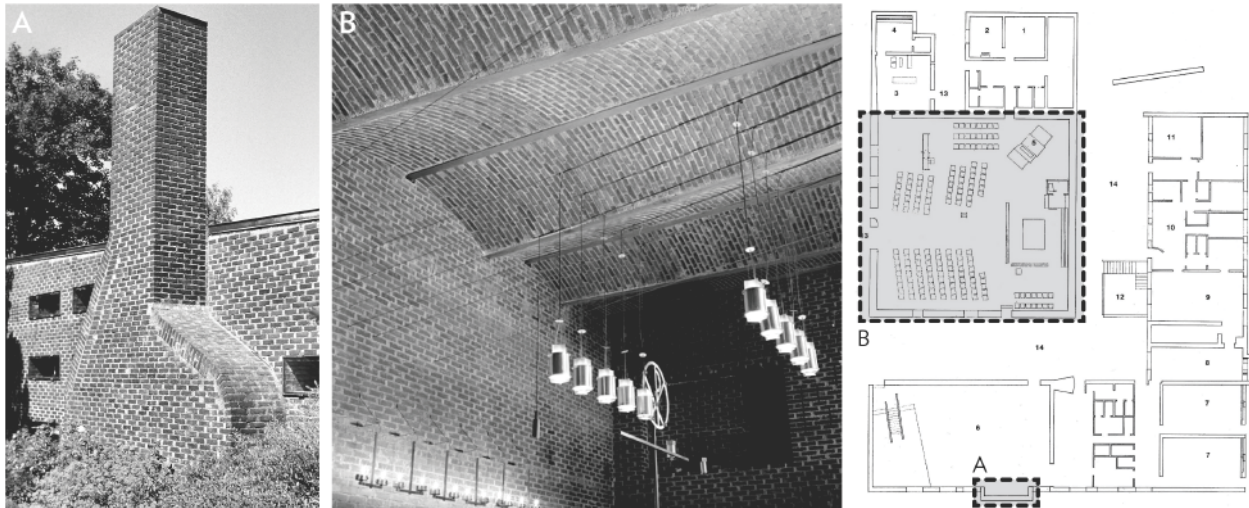


Figure 4: Images of the chimney and vault, as well as a plan reference that contextualizes each prototype

## PROTOTYPES

The church and the vault are key elements within the Church of St. Peter's, which isolate indicative moments of the building's construction logic. As such, the models are prototypes for a method of re-construction, but they are mere elements within a larger building context. (Fig. 4)



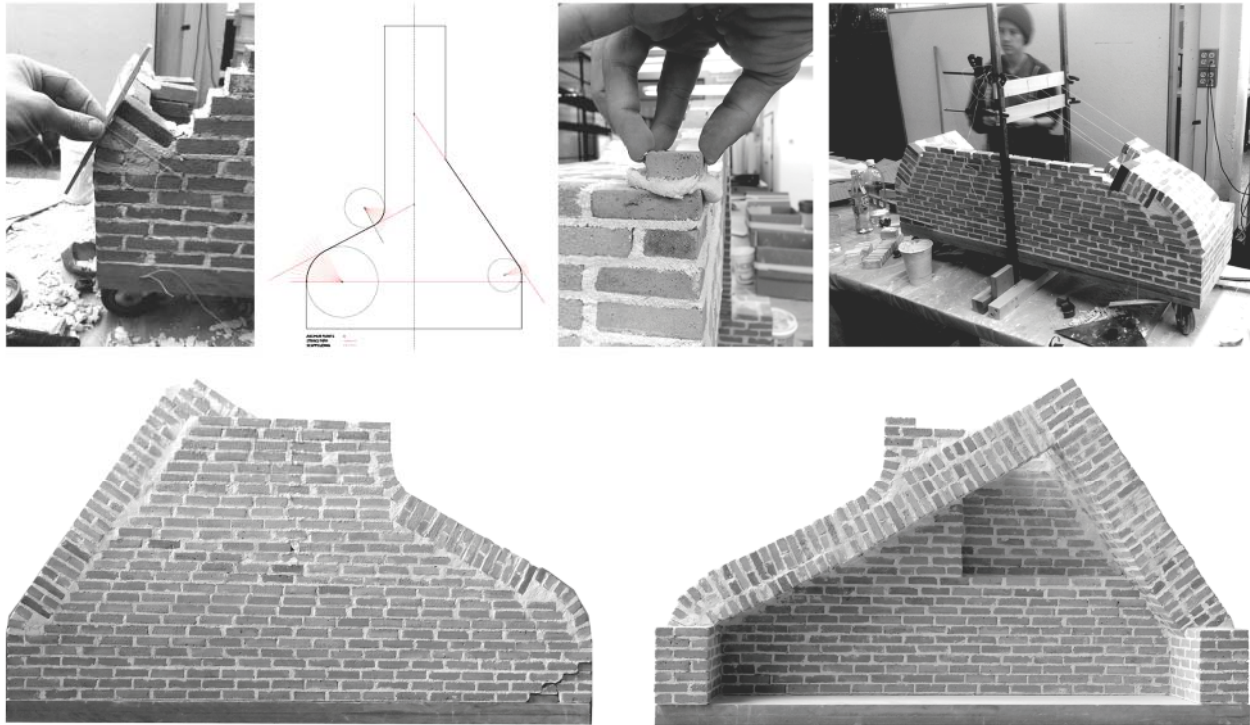


Figure 5: Documentation of the chimney prototype

### Chimney Prototype

The chimney (Fig. 5) is composed of three types of brickwork that are differentiated through their unique reliance on string as a construction guide. These three categories are standard horizontal coursings, radius-based turns, and angled-side alignments. The horizontal courses are laid through the prototypical method of setting two end-bricks and running a string between them as a guide for the infill bricks. Wherever the outer limit of the chimney shifts from a vertical edge to an angled condition, radius-jigs are used to guide the more nuanced placement of bricks rotating about a centerpoint. Linked to the processes of drafting circular segments by hand, the radius-jigs require a precisely located centerpoint upon which a fixed-length of string is attached. The centerpoints are legible in Lewerentz's elevation drawing of the chimney (Fig. 3), which provides insight to a potential construction methodology but stops short of being explicit. To locate the centerpoints in the prototype, linear distances are measured from the edges of the chimney and the ground plane, and small nails are set into each point. As a supplement to the string radii, thin wooden strips are attached to the end of the string in order to guide the angle of the bricks as well. (Fig. 5) Following Lewerentz's logic, mortar joints expand and contract as necessary to ensure that critical datums in the global geometry are met. Whereas the aforementioned radius-jigs rely primarily on locating points within the extents of the chimney prototype, the third brick-laying category, angled-side alignments, demands the establishment of points that project well beyond the limits of the constructed object. In order to accommodate this need, it is necessary to build a scaffolding system that can locate such points and provide structure for them as endpoints in a set of string-guides. (Fig. 5) In the chimney, the angled-sides have distinct slopes and thus intersect the scaffolding system at different heights. The minimum height for the scaffolding system is dictated by the higher of the two intersection points, and the system also requires depth to ensure alignment between the front and back edges of the sloping sides.



Figure 6: Documentation of the vault prototype

### Vault Prototype

At first glance the vaulted ceiling in St. Peter's appears to be a series of alternating cones, with two layers of brick thrusting into non-parallel, steel I-beams. The elevation of the vault shows circular segments transforming into pointed arches. Cones, by definition, have continuously shifting radii and, in addition to this seeming implausible for the purposes of construction, these points suggest that the vaults are actually produced through geometric Boolean operations. Sure enough, the consistent radius of the circular segments matches the radii of the pointed arches, which provides conclusive evidence that the geometric complexity of the vault is formed around a single-radius circle and a series of single-rail sweeps. (Fig. 6) When the circular segments are swept along the non-parallel I-beams, and then conceptually clipped at their intersection, it yields the foundational geometrical unit of the vault at St. Peter's.

This discovery is critical because it aligns with a practical logic of repeatable formwork. The formwork takes the circular segment at its greatest possible length (twelve inches at 1:4 scale) and divides this along the central line of intersection (halfway between the supporting beams) producing a shallow circular segment, six inches in length. Where the section through the vault forms a pure circle, the full extent of the formwork rib is used and, on the opposite spectrum, where the section concludes in the pointed arch, only 60% (3.6 inches) of the single-radius rib is engaged.

The biggest challenge presented by the translation of this abstract geometric operation into a physical armature for construction revolves around the clipping logic. Figure 7 demonstrates how the clipping occurs above the vault, which is problematic because, in order to provide resistance against the forces of gravity, the formwork must be positioned underneath the bricks as they are laid. Additionally, the ribs require some degree of thickness to resist buckling, and this excess material would have to pierce through the vault if it were to extend beyond the clipping intersection. In this case, the optimal solution is to hang the wooden ribs from the underside of the support beams and to extend the extra length of the rib beyond the lower beam. (Fig. 6) These findings are significant because they reveal a strategy of Lewerentz to employ economically-efficient formwork towards the realization of formal complexity.



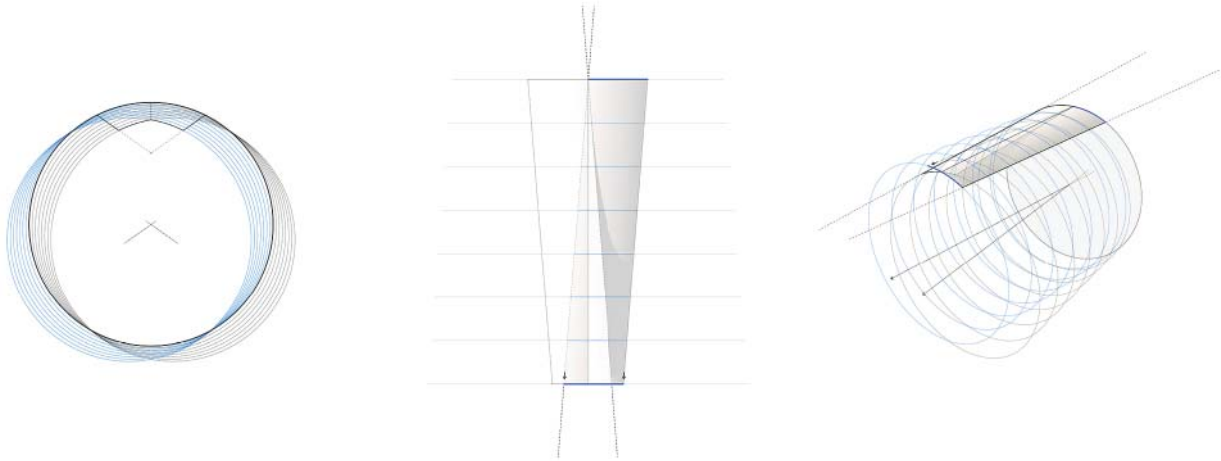


Figure 7: Geometric diagrams of vault, produced in correlation with the formwork conceptualization.

## CONCLUSION

This paper demonstrates, through the act of scaled reconstruction, a series of new understandings in Sigurd Lewerentz's work. Particular findings, such as the Boolean operations of the vaulted ceiling, emerge through this method-driven historical approach. This process serves a vital role in resurrecting knowledge from the past that has been lost to improper documentation; however, it does require significant effort. Accordingly, the selection of prototypes limits the scale of knowledge extraction to particular moments and must be strategic. While the size of the prototypes is limited, they reveal logics that can be applied to other locations within a building and to other works as well. Future research can contribute by reconstructing other key elements in Sigurd Lewerentz's buildings or by applying this methodology to the vast number of intriguing figures in the history of construction whose lessons currently remain untapped.

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