

EARTHQUAKE DISCIPLINE

THE CONSTRUCTION OF A CATHEDRAL

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A central disciplinary debate for Chilean architecture took place in the middle of 18th century at the Cathedral of Santiago. This collective work was the place where the tension between built form and resistance to quakes met.

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A Chilean architectural work, as a solid, physical body, assumes earthquakes. This fact (being an area of earth tremors) imprints its character. This appears already within design stage. (Borchers, 1970)

AN ARCHITECTONIC DEBATE IN SANTIAGO. 1758-1759

The destructive force of tremors was experimented with very early in the *Capitanía General de Chile*¹; this experience gave place to a long learning period that continues even today. During the colonial years, successive earthquakes devastated both public buildings as well as private; the history of colonial architecture appeared to advance from earthquake to earthquake with very few constructions managing to remain standing.

The seismic experience generated a culture not exempt from diverse forms of tensions; among these, it is fitting to highlight that which is produced between the necessary technical requirements to ensure stability and the intention that works must adhere to formal and aesthetic principals established by the architecture. This tension is very evident in discussions taking place during the construction of a new Santiago Cathedral during the 18th century.

The materials contained in a dossier of the Archbishop's archive² (1758) clearly reflect this kind of tension; there relevant aspects about the cathedral's construction between 1758 and 1759 are detailed. The dossier contains reports on construction progress and the correspondence between civil and ecclesiastical authorities referencing the height that should be given to the naves along with two plans that illustrated the discussion on the topic. These documents reveal the difficulty in appropriately confronting earth tremors and, simultaneously, submitting to the contemporary rules of architecture. At the same time, they shed some light on the authorship of the project, revealing interesting details on its construction and the various players that participated in it.

The former Santiago Cathedral, whose construction goes back to 1566, was raised on the eastern side of the *Plaza de Armas* and was oriented north - south. Various disasters and many earthquakes including the earthquake of 1730 that left it seriously damaged had affected it. It is after this catastrophe that the idea was formed to build a new cathedral. Encouraged by the bishop, Juan González Melgarejo, in 1747 the city council acquired, for this end, two neighboring sites to the northeast of the block in 1747; with this construction began the following 1st of June. This act makes up the formal and structural base of the Cathedral that we know today. The new cathedral had more explicit objectives than being larger and having the Plaza de Armas. Obviously, previous experience demanded that the cathedral be solid enough to resist future earthquakes.

This preoccupation acquired more force after the earthquake of 1751 and gave place to a debate that determined the interior height of the cathedral as well as its formal and constructive systems.

THE DANGERS OF HEIGHT AND THE NEEDS OF ORDER

The central discussion collected in the referenced dossier, has to do with the height of the naves. It is surprising that this took place ten years after construction began, at the moment when construction began on the creation of the arches that would give form to the naves. Until then the perimeter walls had been built that advanced from the west to east.

Among the most valuable materials of the dossier two previously unknown drawings were found. The first, an outline, shows a sector of the plan of the cathedral with the measurements of the three naves: nine yards³ for the laterals and twelve for the central. In the same drawing an elevation appears with façade slightly in perspective (supposedly the south) that allows one to better understand the roof of the lateral naves (previous to Cremonesi's renovation) and one can make out the form that the towers of the facade would have had in the first version of the project⁴. The second drawing is colored and presents a much higher level of definition. It consists in a section of the cathedral elaborated by Juan de Alvares, head foreman of the cathedral, in 1758. This includes the fundamental measurements of the heights of the naves in Spanish varas and had been commissioned by the bishop Manuel Alday and Aspeé, a request of the governor and captain general, having with finality, probably, to provide a reference element for the discussion over the height of the cathedral. The necessity of creating this drawing suggests that, apparently, no plans of the cathedral were available because the originals sent for royal approval, obtained in 1753, had been lost. Both drawings are joined to the stages of progress of construction contained in the dossier and correspond to the annual reports that were to be sent to the Spanish throne in accordance with the royal mandate of September 13, 1757.

The discussion included in the dossier appears to be part of a series of tensions around the construction of the new cathedral. The Benedictine monk Gabriel Guarda, in his work on Toesca, signals that in 1751 the *alarife* of the council (Jorge Lanz) and the head foreman of the Santo Domingo Church (Juan de los Santos Vasconcelos) would have taken part in a controversy with the Cathedral's chief builder, Matías Vásquez de Acuña, over the supposed existence of flaws in the construction of the temple (Guarda, 1997). The debate to which the dossier refers coincides with a second discussion recorded by Guarda over the height of the three naves. In agreement with that indicated by the author, the aforementioned Lanz and Vasconcelos, apparently acting as consultants to civil authority, had arrived to propose that there not be differences in height between the three naves which would suggest a church space perceived as a public hall; that design would guarantee its resistance to earthquakes. The information contained in the analyzed dossier supposes, on the other hand, differences between the naves and addresses the magnitude of such a difference.

The final decision on the height of the naves remains entrusted to a commission made up of Lanz and Vasconcelos on the governor's part and the Jesuit architects Vogel and Hagen on the part of the bishop and Vásquez de Acuña. It is fitting to remember that Vogel and Hagen may have participated in the original project for the new cathedral, although their actual contribution was difficult to precise. In the section drawn by Alvares, the height of the side naves appears fixed in thirteen yards, and the central

nave in seventeen, very probably that with which the project sent to Spain was conceived and, in any case, the maximum that had been proposed. This difference of four yards (approximately 3.34 m) appeared to be excessive to the governor's representatives.

Before the commission's report, Vázquez de Acuña appeared disposed to lowering the difference between the naves by half, giving the central nave 15 yards in height, close but lower to the opinion of Lanz and Vasconcelos that defended 15 yards and $\frac{3}{4}$. It is the Jesuits that continue supporting the need for more height: Vogel pronounces 16 yards as the ideal and no less than 15; Hagen, on the other hand, counsels that the minimum height should be 16. Bishop Alday made the final decision with the mayor and *oidor* Joseph de Traslaviña in March of 1759. They determine that the definitive clear interior height should be 15 yards and 17 inches with the inclusion of the socle. The interesting thing is that the decision is supported on two reasons: the proportions of the Tuscan order proposed for the cathedral and the contingency of the earthquakes.

The question of the height of the cathedral and the proportions between the naves remained in the debate over its conclusion, with proposals from architects Eusebio Chelli and Fermín Vivaceta, until the middle of the 19th century. Nevertheless, only recently at the end of the century and little before the Chilean centennial of independence, the building will be submitted to a radical renovation. Among many other aspects of the design with which the architect Cremonesi won the competition in 1898 is the incorporation of the vertical dimension of the cathedral. This is manifested in the proposal of towers for the facade and the addition of a cupola and its needle over the altar. Additionally, Cremonesi will propose the decisive height of the central and lateral naves to include small cupolas –featuring lanterns– in between the columns. Cremonesi specially studied the structural problems derived from such an increase of height.

THE SPANS OF THE DOSSIER

The central matter dealt with by the aforementioned dossier has to do with the tensions between the desire to give the Cathedral the rules of the current architectonic culture and the anxious need to build with a solidity capable of facing the destructive force of earthquakes. The first remains in evidence already in 1753, when references to classical authors (concretely Palladio, Scamozzi and Vignola) informed the determination of the proportions of the arches of the cathedral (Pérez, 2009). The security demands facing the quakes became particularly intense when the available knowledge depended on a process of trial and error of unforeseeable consequences. It lacked the procedures and rules of structural calculation. In any case, one must underline that the stone structure of the cathedral from the 18th century, even with posterior modifications, has notably resisted the impact of the quakes.

Additionally, this documentation has revealed another series of clues to the knowledge of its constructive process. For example, issues related to the form of the cathedral of the 18th century, drawn by its authors albeit only partially⁵. On one hand, the elevation allows us to understand the problems of the church roofing and how much the fragmentation of the roofs of the side naves known until now by photography and drawings from the 19th century, were intimately connected to the small difference of height between the naves and the need to guarantee the illumination of the central nave. The simplified presence of the towers demonstrates the idea with which Vázquez de Acuña and their circle had conceived them. Lastly, the section allows us to understand how much the current cathedral, despite all the changes it underwent, owes its interior spatiality to this first project. The descriptions contained in the documentation allow us to come closer to a reconstruction of the plan of the cathedral as it had been conceived even before the Toesca intervention at the end of the 18th century.

A third aspect of interest arisen from this documentation has to do with the authorship of the project, that traditional scholars such as Pereira Salas or Iglesias and Porte had attributed to Vázquez de Acuña. Gabriel Guarda, for his part, awarded a much more decisive responsibility to the Jesuits Vogel and Hagen, trained as architects, supposing that Vázquez de Acuña was merely commissioned for the construction of the cathedral. In the dossier, Vázquez de Acuña is attributed to the initial design of the project without it being possible to clearly determine if the Jesuits simply revised or approved or created a better-drawn version of the said project. It continues to create a mystery over the reasons for which it was Alvares and bit Vázquez de Acuña who prepared the drawings at the request of the bishop. Above all, the maximum interest results in confirming the collective nature with which decisions were taken for such a significant project for ecclesiastical and civil authorities that required even royal approval.

Finally, the central matter debated in this dossier has to do with that permanent tension between form and technique that is at the heart of the architectonic discipline. In this case, it must face a phenomenon to which classical treatises made practically no reference: the radical instability introduced by the quakes, phenomenon that Chile had to face with particular intensity from its remotest origins. **ARQ**

- 1 That is the name that the Spanish throne gave Chile during the Colony; Chile was a small border territory related to Peru Viceroyalty (Translator's note).
- 2 Archive identified as part of the investigation for the project FONDECYT 1090325 *The block of the cathedral, the path of history*. Investigator in chief: Fernando Pérez Oyarzun; co-investigators: Macarena Ibarra Alonso, Claudio Labarca Montoya, Claudia Prado Berlien, José Rosas Vera; project coordinator: Marco Barrientos Monsalve.
- 3 The Spanish version of the article indicates these units as *varas*, an ancient Spaniard unit equivalent to 2,74 feet approximately, or 0,91 yards. For an easier reading the term *varas* has been replaced by *yards* in the English version, considering their proximity (Editor's note).
- 4 At the end of the 19th century the Roman architect Ignazio Cremonesi developed a radical, high-profile reformation of the church after winning a competition.
- 5 There are no other known drawings of the cathedral construction, for this reason the importance of these is considerable.

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