# The Art du Trait in the Monastery of La Vid in Burgos (Spain)

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## Introduction

Stone construction has always been influenced by the *Art du Trait*, wich is, in turn, closely linked to the Art of Stonemasonry. It is not possible to understand one without the other.

The *Art du Trait* is an essential discipline to learn the secrets of stone construction. It is the best way to discover how to turn an inert, lifeless block of stone into an arch, vault, or staircase; in other words, it helps us understand the construction processes carried out by the stonemasons during the construction of a great stone monument. It allows us to decipher the absolute or partial volumetrics of a building, as the physiognomy of a construction may be controlled through a series of geometric exercises [1]. This Art belongs to the architectural praxis, and since practice is the mother of theory, "las distintas operaciones realizadas en la producción de una obra son una fuente de conocimientos [the various operations carried out in the production of a work are a source of knowledge]" [2]. The *Art du Trait* was one of the necessary skills that architects had to master [3], and its execution was already of an exceptional quality in Spain as early as in the fifteenth century [4].

This discipline developed in the stonemasonry workshops, known as 'tracing houses', which were common in Spain, England, and other countries. They were generally located in the buildings themselves, where an area was set aside for this purpose; however, they could also be established in other spaces within the factories, such as the tribunes, terraces, choirs or under the staircases [5]. The master stonemason would make the necessary full-scale tracings, architectural drawings, and templates in this 'mobile' or 'itinerant' workshop [6]. Tracing houses in Spain are known to have existed in El Escorial [7] and in the cathedrals of Granada [8], Salamanca [9] and Seville [10]. On the other hand, the cathedrals of York and Wells stand out as English examples [11]. In the case of York, this room: "provided accommodation for the Minster masons to work in comfort, having a large fireplace in the south wall of the eastern arm, and a garderobe entered by a passage form the east side of the southern arm. The plaster floor now extends over the whole of the southern arm and may originally have reached to the north wall, providing an area more than 40 feet long by over 16 feet wide. Such a space was needed in order to set out accurately the shapes of large windows, the curves of vaults, and other major details of the building" [12].

Within these workshops, the masters would make the tracings through a series of simple geometrical formulae [13], primarily following the *geometry fabrorum*, "la aprendida, usada y desarrollada por los artesanos [the one learnt, used and developed by craftsmen]" [14]. The tracings are the result of this *geometry fabrorum* and are considered one of the three means of graphic control in architectural practice [15].

These tracings helped the stonemasons to have precise control over the element that was being built [16] and were carried out using straight lines and curves [17], with an accurate principle of economy that allowed the use of minimum resources. This system of 'economy of means', whereby the master "solo dibuja aquello necesario para definir el elemento a construir [draws only what is necessary to define the element that needs to be built]" [18], also implied an 'economy of space' that allowed the reuse of the supports on which the different tracings were superimposed on top of each other [19]. The use of full-scale tracings proves that "medios sencillos utilizados con oficio, bastaban para resolver problemas

arquitectónicos complejos de generación y control … sin necesidad de recurrir a teorías sofisticadas que han alimentado la historia de la arquitectura hasta fechas recientes y de las que aún quedan seguidores pertinaces [simple means, when used with skill, were sufficient to solve complex architectural problems of generation and control ... without the need to resort to sophisticated theories that have nourished the history of architecture until recently and that still today have stubborn followers]" [20].

This paper will focus on the tracings of the monastery of La Vid in Burgos (Spain). However, some examples from other countries are worth highlighting, as they do reinforce the importance of this discipline. The tracings of the Temple of Apollo at Didyma, dated around 250 B.C. [21], stand out for their antiquity, as do the tracings found in the Mausoleum of Augustus for Hadrian's Pantheon in Rome [22]. In the aforementioned tracing house of the York Minster, numerous full-scale tracings have been preserved, including, among others, the tracing for the window tracery of the Lady Chapel, built around 1365 A.D. [23]. A similar example can be found in the Wells Cathedral's tracing house [24] and in the Cistercian abbeys of Byland (Yorkshire) and Jervaulx (East Witton), where some vestiges of tracings have been discovered [25]. In France, which holds an important stone building tradition, architectural drawings have been found in the cathedrals of Soissons [26], Clermont-Ferrand [27], and Chartres [28], but also in the temples of Bourges, Troyes, Trogir, and Orléans [29] and in the basilica of Saint-Quentin [30]. Some interesting drawings have also been found in the Anatolia region [31], ad-Dayr (Petra) [32], and Marrakesh [33]. All of them help us grasp the importance of the *Art du Trait*.

## The *Art du Trait* in Spain: theory and practice

The theoretical aspects of the *Art du Trait* in Spain were reflected in the notebooks, manuals, and treatises where the master architects recorded their stonemasonry knowledge. These treatises on full-scale tracings detail how a construction is built [34] and the necessary techniques to carve up any type of architectural element (arches, vaults, staircases, etc.) [35]. These manuals, gathered by and for architects themselves, comprised both the theoretical explanation for diverse construction models and engravings defining such elements [36]. Most of these texts are in the form of manuscripts, as there was a certain secrecy surrounding the trade of stonemasonry, a sense of discretion inherited from the medieval guilds [37]. Few of them ever got printed, due to the high cost of printing such a large number of engravings and to the limited scope that this type of work could have beyond the professional stonemasons [38]. The oldest surviving text that contains some notions on stonemasonry techniques is the *Llivre de portraiture*, compiled by the Picard master Villard de Honnecourt in the thirteenth century.

The stonemasonry literature preserved in Spain is much later, although very rich. The first manuscript is dated around 1540 A.D., and similar texts were written until the end of the eighteenth century, with a total of 20 treatises of extraordinary importance. The writings of Alonso de Vandelvira (ca. 1585), Ginés Martínez de Aranda (ca. 1600), Fray Lorenzo de San Nicolás (1637 and 1663) and Tomás Vicente Tosca (1707-15), among others, stand out. Fray Lorenzo wrote *Arte y vso de Architectvra* in 1637, but also the continuation *Segunda parte del Arte y vso de Architectvra* in 1663, due to the objections that master mason Pedro de la Peña presented before the Royal Council. That second part served as a response to these objections [39].

Many of these manuals included designs of church plans, façades and architectural decorative elements, and drawings of the foundations necessary for the construction, in addition to practical instructions on the cutting of the stones. These texts help us identify, in most cases, the possible layouts of the stone monuments, but also allow us to understand the technical processes carried out by the stonemasons for the execution of the different architectural elements that make up a stone building.

As for the practice of the *Art du Trait* in Spain, there are progressively more discoveries of architectural drawings in some of the most significant buildings of the Spanish monumental corpus. The most significant examples are the texts found in the cities of Santiago de Compostela [40], Madrid [41], Seville [42], Jaén [43], Cuenca [44], and Salamanca [45], among others (Fig. 1).

*Figure 1: Full-scale tracings in Spain. 1a Jaén Cathedral. 1b Cuenca Cathedral. 1c New Cathedral of Salamanca. Photographed by the author.*

## The full-scale tracings found in the monastery of La Vid

The monastery of Santa María de La Vid in Burgos (Spain) was one of the most powerful abbeys of the Premonstratensian order in Castile [46] (Fig. 2). In the sixteenth century, the main chapel, among other parts of the group, underwent a thorough architectural transformation, promoted by the Zúñiga family, which replaced the old Romanesque chapel [47]. We will not dive into the construction history of the monastic group, as important studies on the subject have already been made [48], but only focus on the architectural drawings found inside the workshops.

*Figure 2: Monastery of Santa María de La Vid (Burgos, Spain). Photographed by the author.*

A number of tracings belonging to the different periods of intervention carried out on the ensemble are kept inside the walls of this magnificent building. The type of stone used for the construction, a very white sandstone from the Ciruelos de Cervera quarry (in Burgos, Spain), has hindered the research. Moreover, some rather aggressive interventions were carried out on the stone, possibly at some point in the recent history of the monastery, further complicating the work of locating and identifying the tracings. The incisions of the tracings can hardly be distinguished, so we had to mark these lines with white chalk. The tracings can be seen from a certain distance with the help of a camera. We have selected four of the 38 locations with tracings in La Vid, which are scattered throughout the different rooms of the monastery ensemble. The selected tracings are found inside the monastery church (Fig. 3).

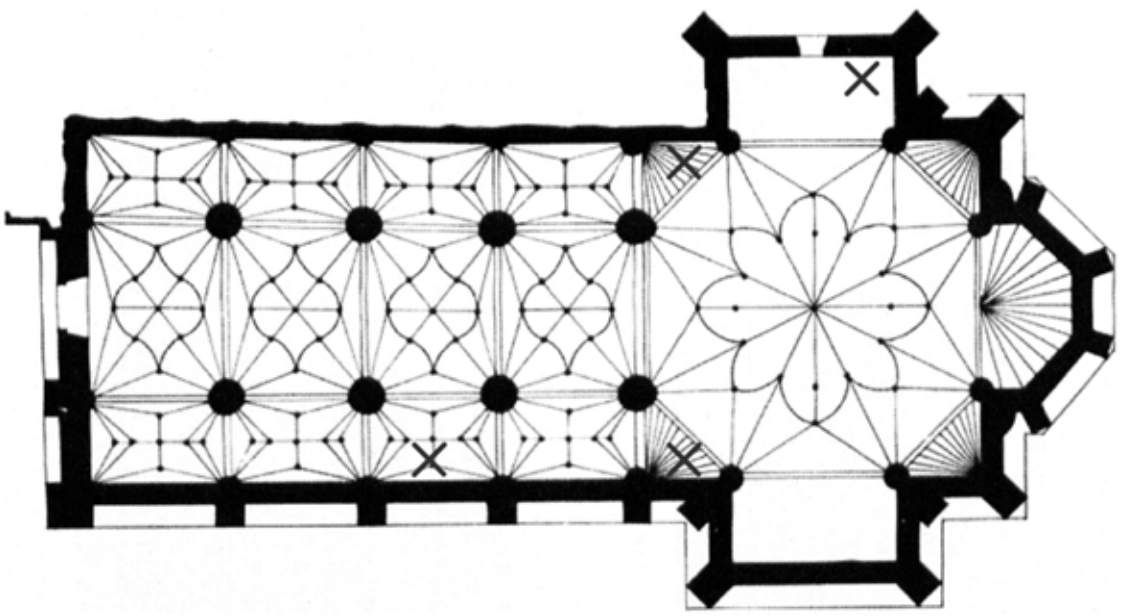

*Figure 3: Location of the tracings on the ground plan of the church of Santa María de La Vid, drafted by J. D. Hoag.*

In the first place, on the north wall of the transept we can find a series of tracings that seem to refer to the church access door from the interior of the ensemble, located in the transept (Fig. 4). They show a clear predominance of straight lines (mainly vertical and horizontal, but also a few diagonal ones), and a line that delimits the back of the lintelled arch at the top (1.46 metres long) can be observed. On the right side, several parallel lines run down from the back of the lintel, marking the molding of the jambs (1.21 metres long), while the diagonal line marks the junction between the lintel and the jambs on the left. In addition, another series of smaller incisions can be seen on the lower left side. The tracing is incomplete, which makes it difficult to ascertain the exact architectural element that it refers to. However, the proximity and similarity to the aforementioned door has led us to formulate this hypothesis.

*Figure 4: 4a Tracings. 4b Church entrance door. Photographed by the author.*

On the wall of the Gospel side, in the part of the transept before the grille that marks the division between the main chapel and the naves of the church, there is an interesting set of tracings which were probably made during the second stage of the construction, after 1542 [49], possibly under the direction of master Pedro de Rasines [50]. These large layouts (approximately 3.12 metres wide and about 2.85 metres high) are clearly superimposed and allow us to distinguish several architectural elements (Fig. 5). In the central right-hand side, we can see the cornice of an entablature, where the cymatium and the eaves can be distinguished. Right below this element, there is a geometric exercise known as 'The Seed of Life' as part of the 'Flower of Life', within the so-called 'Sacred Geometry'. On the left side, we can observe three concentric curved lines which, although incomplete, seem to represent a quarter of a sphere and correspond to the tracing for the construction of the squinches in the shape of scallop shells that serve as a transition from the square space of the transept to the octagonal vault, just above the tracings, so we can assume that the layout was probably made in different plans. This can be observed, for example, in the central part of the tracing, where the semicircles would refer to the *venera* (the scallop shell), although they are not found in the arch of the squinch. At the lower left side, we can find two triangular figures that seem to refer to the base of the squinch. Two incomplete circles can also be seen in the lower central part.

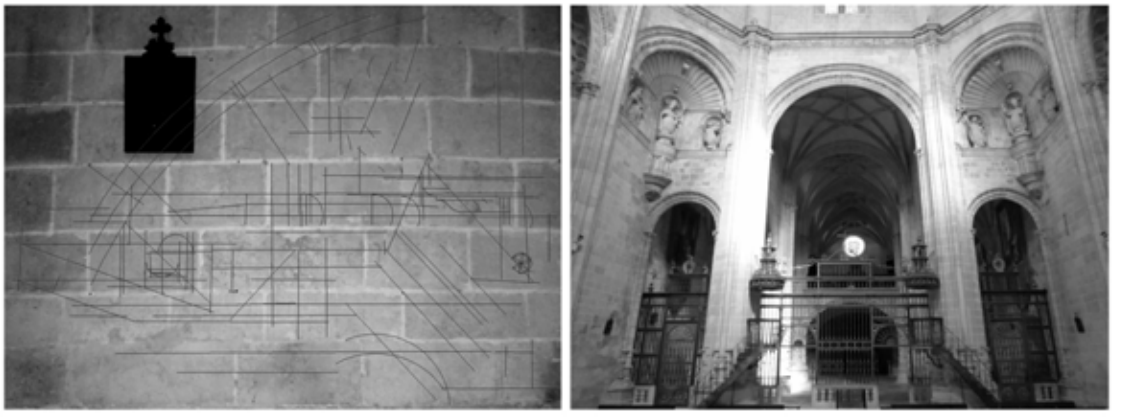

*Figure 5: 5a Tracings digitally processed by J. Santos. 5b Interior of the church main chapel of the monastery of La Vid. Photographed by the author.*

The manuscript of Alonso de Vandelvira (ca. 1585) includes the description and model for the construction of a 'pechina abenerada' [51] (a pendentive in the shape of a scallop shell) which, despite obvious differences and considering the overlapping of the tracings, shares some characteristics with the drawing found (Fig. 6). Unlike other squinch models in the manuscript, Vandelvira only focuses on the decorative aspect of this model but not on its architectural construction, since a shell shape could be carved in almost any type of squinch. In fact, the stonemason had to build this element following the instructions given for the 'peçhina quadrada' [52], so only the master would proceed with the shell-shaped decoration of this other model. To this aim, the fluting, known by the author as 'çerçha cabada' [53], was carved in the intrados plans of each voussoir. This truss was obtained by drawing the section of a standard voussoir, on which the stonemasons would then trace "la silueta de los traineles o juntas entre dovelas desde la imposta … hasta la clave [the silhouette of the traineles or joints between voussoirs from the impost ... to the keystone] [54]".

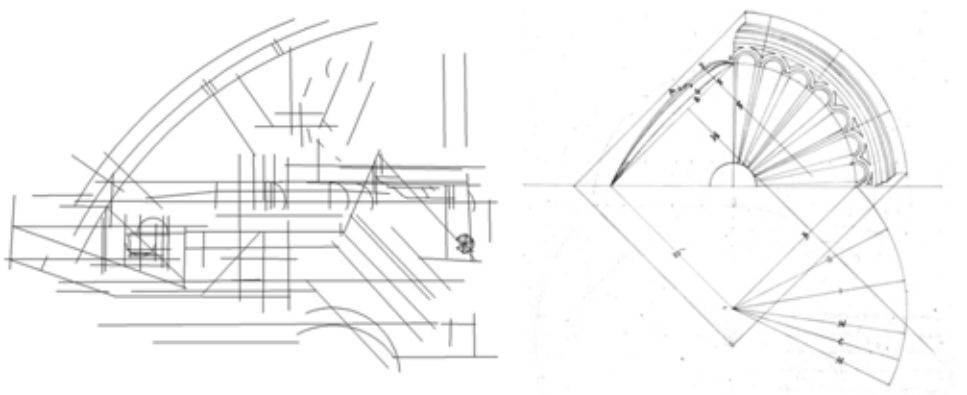

*Figure 6: 6a Tracing vectorised by J. Santos. 6b 'Pechina abenerada' by Alonso de Vandelvira.*

Just opposite to the previous one, on the Epistle side, the incomplete design of a semicircular arch is preserved (Fig. 7). The voussoirs are 20 centimetres in width and are located about 3.6 metres above the ground, so the use of a scaffold was needed to examine the tracing. In this case, the tracing seems to refer to the arches that give access to the side aisles of the church and link the chapel to the aisles (Fig. 5b). Despite stonemasonry literature addresses the construction of arches, semicircular arches are generally not detailed, as they are considered the simplest model. Vandelvira does include the semicircular arch in his manuscript as part of the 'Roman' arches, although he does not develop its parts or geometry for that same reason [55].

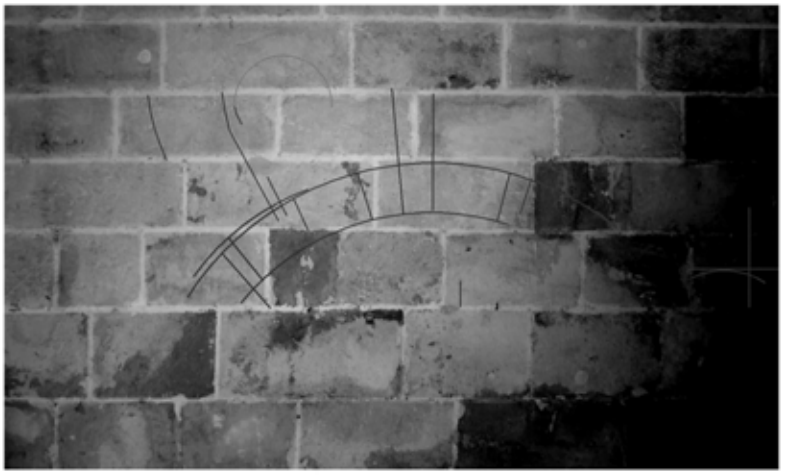

Fig. 7. Tracing of semicircular arch. Photographed by the author.

In the first third of the eighteenth century, the church of the monastery underwent a major renovation. The medieval body of the church was replaced by the one that remains today [56]. In the third section of the Epistle aisle we can observe the outline of a ribbed vault (Fig. 8). This drawing, which is not incised but drawn on the stone, represents nine keystones on a small square plan (30.5 x 29 centimetres) with tiercerons and liernes, and it is very similar to the vaults that cover the sections of the church naves, although these were built based on a rectangular plan. This drawing was not meant to serve as a template for the carving of the voussoirs in the construction of a ribbed vault. Furthermore, the irregularities in its execution indicate that it is a freehand sketch, which could mean that it is in fact an advice or instruction by the master so that his stonemasons could get an idea of what they were to execute.

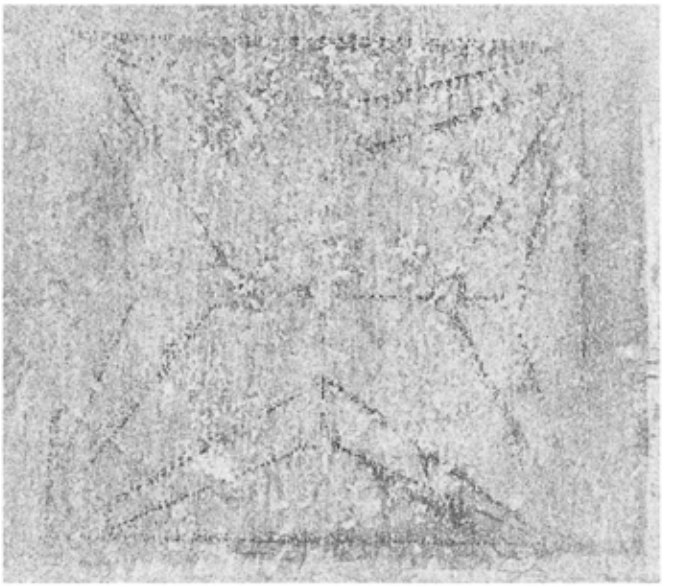

*Fig. 8. Tracing of a ribbed vault. Photographed by the author.*

## Conclusions

The Art du Trait is a fundamental discipline for understanding our stone building past. It is essential to understand the construction processes carried out by master masons to build the great stone monuments that surround us. It is also a key part of the architectural heritage, especially in countries where monumental stone construction is predominant. In the case of Spain, it is particularly important to be acquainted with this discipline, as a large part of its monumental landscape is built in stone.

Full-scale tracings are the essence of the Art du Trait, as they provide valuable information regarding the building where they are located, hence the importance of its study, dissemination, and conservation. However, locating this type of heritage is not easy. The location of the drawings and the characteristics of the material where they were made affect their condition. Natural erosion through time and human intervention, often unconscious when they are on the ground (due to footsteps), as well as the general lack of knowledge surrounding these architectural drawings, can lead to the loss of this extraordinary information. Human action can be decisive in their conservation or their disappearance.

The dissemination of these tracings is not only important to the scientific community. It is necessary to disseminate the drawings to the general public to promote their protection, especially considering that most of them are located in monuments that can be visited. An initiative that could be mimicked is the strategy carried out in the Seville Cathedral,

where the important tracings located on the rooftops have been incorporated into the guided tour of the temple, so that anyone who visits it will have the opportunity to learn what a tracing is and see them in situ. This way, the public will begin to appreciate the importance of these drawings and, as a result, their disappearance will be prevented in the future. There are cases of incomplete or mutilated tracings, or with later elements placed on top. On some occasions, some treatments were applied to the walls for the conservation of the monument which however have led to the total or partial elimination of the tracings originally made by the masters who built it.

The tracings found in the monastery of La Vid are a further testimony to the importance of the Art du Trait. Despite the large number of tracings found within its walls, it is striking that they have not been noticed until now. This may be due to several factors: the general lack of knowledge around this discipline, which has caused that it has not been given the care it deserves; but also because of the building material of the monastery. Even so, they are part of its construction history and deserve our full attention. Since "El Arte de la Montea nos permitirá entender mejor los orígenes de la Construcción y de la Arquitectura [The Art du Trait will allow us to better understand the origins of Construction and Architecture]" [57], we must continue to try to 'understand', as history still awaits us.

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[48] Entre otros: I. Cadiñanos, 'Proceso constructivo del monasterio de La Vid (Burgos)', *Archivo Español de Arte*, no. 61, 1988, pp. 21-36; M. J. Zaparaín, *El monasterio de Santa María de La Vid. Del medievo a las transformaciones arquitectónicas de los siglos XVII y XVIII*, Madrid: Religión y Cultura, 1994; B. Alonso, 'De la capilla gótica a la renacentista: Juan Gil de Hontañón y Diego de Siloé en La Vid', *Anuario del Departamento de Historia y Teoría del Arte*, no. 15, 2003, pp. 45-57; J. Escorial (note 46).
[49] I. Cadiñanos (note 48), p. 24.
[50] B. Alonso (note 48), p. 51.
[51] A. de Vandelvira, *Libro de traças de cortes de piedras*, Biblioteca Nacional de España, MSS/12719, *ca*. 1585, p. 15.
[52] Ibid., p. 2.
[53] Ibid., p. 15.
[54] J. C. Palacios, *Trazas y cortes de cantería en el Renacimiento español*, Madrid: Munilla-Lería, 2003, p. 51. Translated by author.
[55] A. de Vandelvira (note 51), p. 26.
[56] M. J. Zaparaín, 'El monasterio de la Vid en el arte de la Ribera' pp. 33-98 in L. Marín (Coord.), *El Monasterio de Santa María de la Vid: 850 años*, Madrid: Religión y cultura, 2004, p. 77.
[57] J. Fernández, 'Geometría y función estructural en cantería. La cantería y la estereotomía de la piedra en el aprendizaje del arte de construir y otras consideraciones' pp. 189-196 in A. de las Casas, S. Huerta y E. Rabasa (Eds.) (note 13), p. 189. Translated by author.