TRADITIONAL DRAWINGS VERSUS NEW REPRESENTATION TECHNIQUES

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ABSTRACT:

The publication of important works of documentation with photogrammetry of two monuments of the city of Seville serve as the basis for a reflection focusing on the traditional systems of architectural representation and their possible substitution by new techniques based on three-dimensional digital models obtained since the advent of laser scanners. Taking into account that CIPA has concerned itself more, in these last few years, with technological advances and their adaptation to applications in the field of conservation of the heritage than with adequately following the real applications that in practice are made with such advances, we suggest the advisability of evaluating, if only provisionally, the application and utility of the new arising methods.

1. INTRODUCTION

The recent culmination of two important works of architectural documentation and their publication in a form that is unusual today but which follows the tradition reflect on the validity and utility of those systems of representation linked to the discipline of Descriptive Geometry. The survey of Seville Cathedral includes in its printed version 60 sheets in a 40 X 60cm format with as many drawings of plans, elevations and sections of this notable monument, which is included on the World Heritage list (Almagro *et alii* 2007). This work, carried out almost entirely using classical photogrammetry (photos in gelatine base, analytical plotting and the final editing in CAD) has been developed in the last ten years and constitutes the most important graphic documentary base that this monument and possibly any other building in Spain of similar importance has ever had.

At the same time, documentation of Seville's Collegiate Church of El Salvador was carried out. This is a monumental complex that also contains the remains of the primitive mosque of Ibn 'Adabbas, the patio and minaret of which are conserved, although with notable transformations. During the course of the restoration works carried out, other remains of the Muslim building appeared and these have been documented as well.

Fig. 1. Album of the Seville Cathedral survey

2. THE SURVEYS

The work of systematic survey of the Cathedral was started in 1996, although other works previously carried out, such as documentation of the conserved elements of the Almohade mosque of the Patio of the Orange Trees and the ancient minaret that is now the bell-tower known as the Giralda, were included in the final publication. The work of documentation was executed using two semi-metric cameras, the Rollei 6006 *metric* and the Hasselblad SWC, the latter converted to semi-metric in the same School of Arab Studies (Almagro 1996). For the measurement of control points, Wild T1000 and TCR303 tachymeters were used, the latter with a laser distance meter. The restitution was carried out with Leica SD2000 and Adam MPS2 stereo-plotters. All the drawings were done digitally using AutoCAD software.

The survey of El Salvador Church was begun in 2004. In that case, the VSD digital restitution system produced by the AGH University of Krakow (Poland) was the one principally used. Images, later scanned, were obtained using a metric Zeiss TMK6 camera. Topographic control was carried out with a total station Leica TCR303.

The final result of these works is actually a series of three-dimensional models in CAD containing a large quantity of information, of the measurements as much as the shapes of the objects and with possibilities of visualisation in very diverse forms (orthogonal, oblique and centred projections). Even when this information is available, in its digital form it cannot be consulted except via a computer, using the appropriate software. These instruments are widespread today in technical professional spheres, but less so amongst the general public and amongst professionals from other fields but who are also involved in conservation of the cultural heritage.

The decision adopted by those responsible for these monuments, both of them very well-known and much-visited – one for its artistic value, which has given it great renown as the largest Gothic cathedral in the world, (recorded as such in the Guinness Book of Records) and the other for the devotion and deep-rooted support of people in the city, who doubtless were drawn there even in the times before it was a church – of

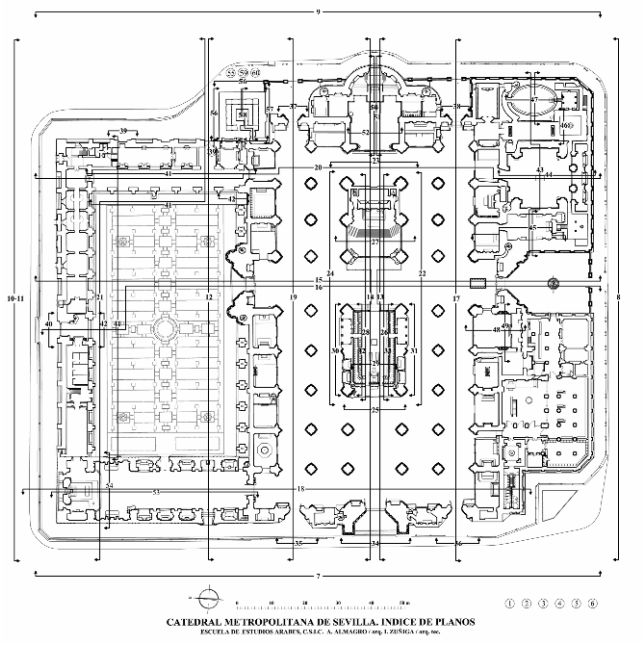

Fig. 2. Key plan of the cross sections of the Cathedral

making this documentation public in the form of printed plates, should give us cause for reflection on the continuing validity of such means of architectural representation and on the validity and acceptability of other systems, especially those connected directly and almost exclusively to computers.

3. REPRESENTATION TECHNIQUES

The development of applied technologies for documentation of cultural heritage and the appearance of new ways of representing architecture oblige professionals involved in the tasks of conserving this heritage to reflect on the efficacy and the real possibilities of utilising the results obtained by these new means. What we have come to know as architectural surveys is no more than a way of recreating a reduced model of the object capable of containing enough information to allow the transmission of adequate knowledge of it as well as enabling the necessary decisions to be made for its appropriate conservation.

Traditionally, the model is generated through the use of drawings carried out following the rules of descriptive geometry, obtained by orthogonal projections onto plans in which the vertical direction of the space is the only obligatory reference. This system of representation, although it sometimes produces images of the object far from those afforded by our visual experience, allows us to obtain information of a metric type in a direct way. On the other hand, the line drawing compels us to simplify the object, based on a selection of the most significant elements, which despite its subjectivity, facilitates the comprehension of the building. The systems used until now, direct measurement or photogrammetric plotting require the participation of an operator who is responsible for analysing the object, extracting the significant data and producing the representation.

The new technologies available today or being developed. particularly laser scanners (Andreozzi 2003), tend towards indiscriminate acquisition of information, which is dealt with in an automated fashion through computer systems from which the model, that is the object of the survey, is constructed. The manipulated data are usually three-dimensional coordinates of points and chromatic information relating to the point of the object. With these, highly spectacular images and representations of the object are generated, but in our opinion their practical use creates serious drawbacks when applied to conservation. One could say that the new technologies are based mainly on automated systems that acquire great quantities of information, which is dealt with and selected automatically by the system and which, in the end, leaves the user with the responsibility of making a definitive interpretation, selection and codification.

It has to be taken into account that a great mass of crudely stored information is not necessarily more useful than information that is appropriately selected and interpreted. It is difficult to admit that the clouds of points or photographically realistic three-dimensional models, although impressive, permit a better understanding of the dimensional and spatial reality of a building than one that provides a good series of ground plans, elevations and sections, carried out following the traditional procedures and criteria.

The handling of the information obtained by the new procedures always requires technological systems, generally computer systems (hardware and software), many of which are at this moment in time expensive and not easy to manage. This means that the end users find themselves very restricted in terms of exploiting the possibilities and advantages offered by the systems.

In any case, it has to be taken into account that due to the traditional training most of the technicians have received they are mentally better prepared to interpret and assimilate the information contained in traditional drawings than in the three-dimensional images supplied by the new techniques. For this reason, despite the spectacular nature of these images, it is doubtful whether they are really useful in the everyday activity of conservation, for the two reasons mentioned above: the need to rely on adequate technological means, not only in the office but on many occasions also on the ground, and lack of training and ability to understand the information provided.

Another by no means unimportant matter is that in the absence of an analysis and interpretation of the object by the person who carries out the survey, which, in short, is virtually entrusted to the computer system, the interpretation must be made by the end user. Although this certainly has clear advantages if the surveyor is not an expert in architectural drafting, it also has the drawback that he/she may lack the necessary resources, without direct contact with the object, to be able to do it in a different way. The matter proves even more critical if the end user is a non-specialised layperson or if the works have to be printed on paper. The transformation of the data obtained by automated documentation systems on conventional drawings continues to be a topic that brings us back to the procedures of traditional documentation.

This aspect of representation, based on the simultaneous analysis and interpretation of the object, is indispensable in traditional systems but now tends to be avoided, partly due to the search for more and more automation, but also because for those who develop the new systems, this aspect is not a priority. It is clear that all these aspects present themselves at two different levels of use and application of the documentation. One is the use of the information by technicians and those in charge of conservation of the heritage, those who in principle we assume to be more familiar with all types and forms of

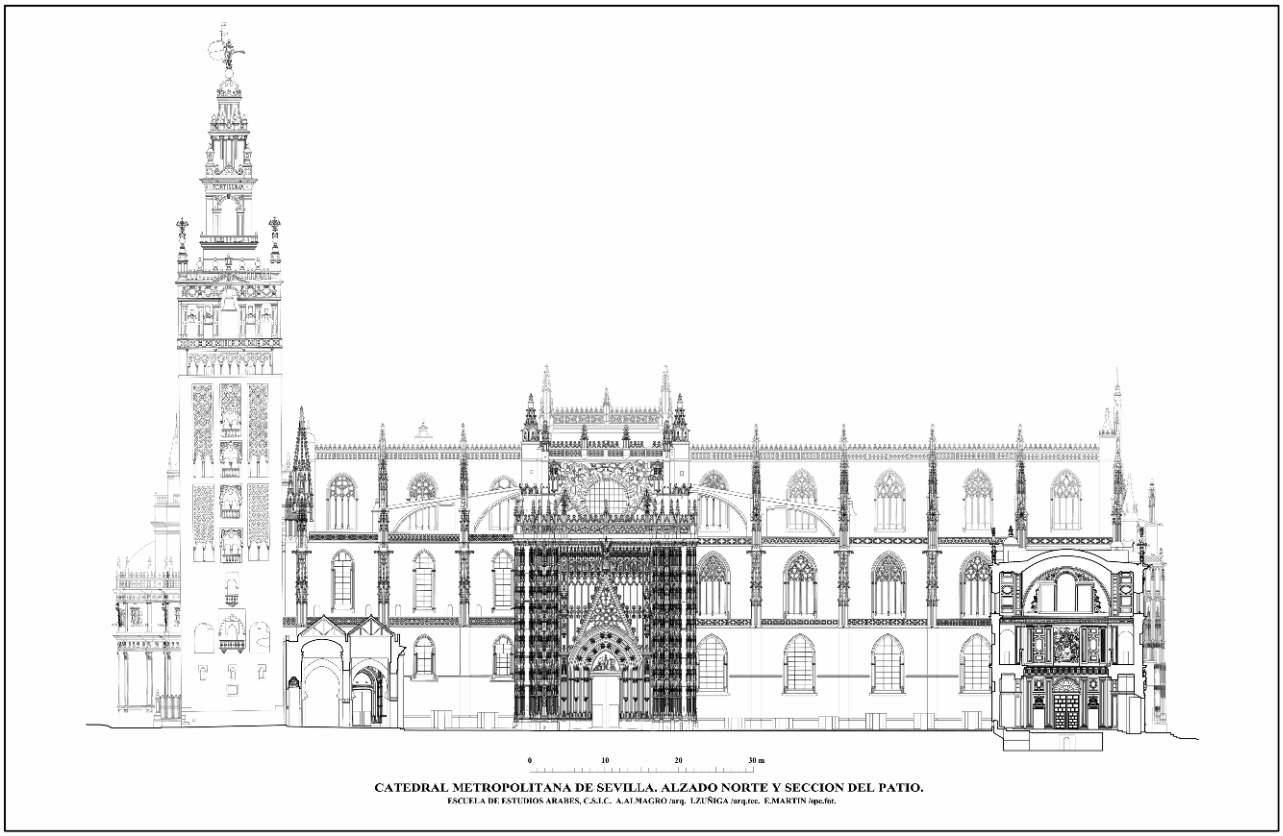

Fig. 3. North façade of the Seville Cathedral

Fig. 4. Cross section of the Cathedral and the Main Sacristy

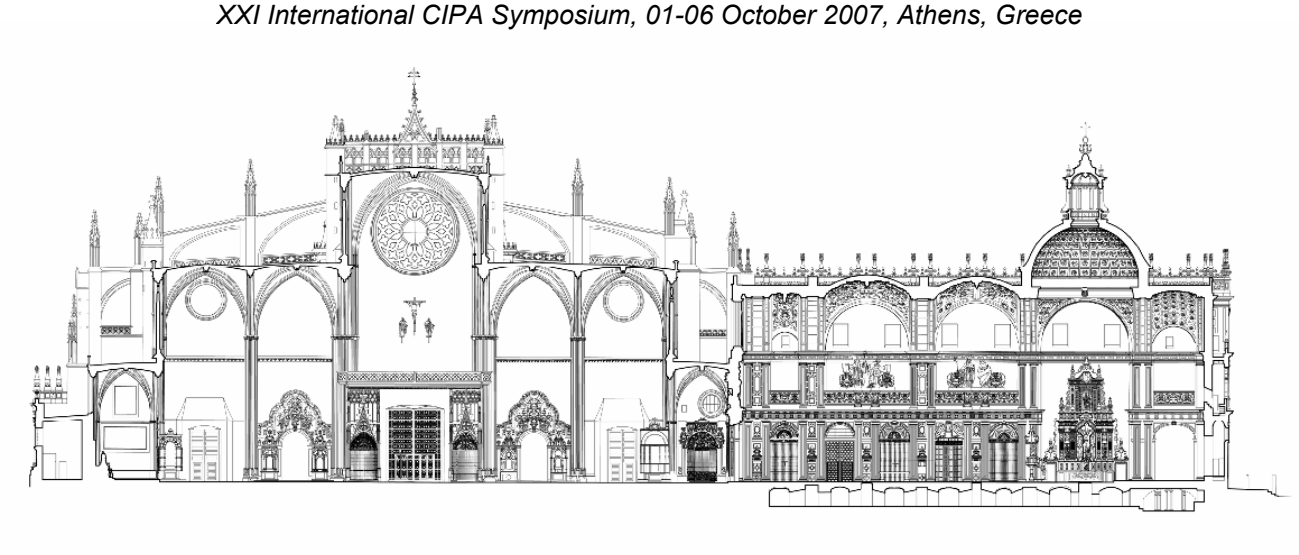

Fig. 5. Cross section of the Cathedral and the Sacrarium Church

representation. But this same aspect is not so evident, basically for two reasons. In the first place because the dissemination of new techniques, which have undergone great development, is still far from having reached the real knowledge of, let alone assimilation by, a significant number of technicians. And above all, the problem remains not only one of providing instruments capable of carrying out the survey but also of having the necessary software to utilise and take advantage of the results.

The other sphere of users of the documentation, those professionals who are less technologically proficient (art historians, archaeologists, administrators and conservators trained in most of the cases in the field of humanities) and, above all, the general public, citizens from a great variety of educational backgrounds but with a growing interest in culture and the heritage, certainly need much more thoroughly devised products and these do not generally arise instantly from data-gathering works.

The process in which we find ourselves involved is reminiscent in a way of what occurred years ago with photogrammetry. Its magnificent possibilities were paralysed by the high price of the instruments and the necessity for high skill technicians with adequate and sufficiently complex training. However, the results obtained with these methods, always in a paper medium, were immediately useful to any user, since they were carried out following the same principles of representation universally used and accepted. These days, the clouds of points generated by a laser scanner are of no use to anyone to whom the appropriate software for its operation and visualisation is not available, and even when it is, it will still not bring the desired information unless it has been produced in the form of vector drawings or models with textured surfaces. Only then will one be able to obtain images on paper with qualities similar to traditional, universally comprehensible ones. But at this moment in time, such a step is far from easy or automatic for objects and buildings like those represented in the works we present here.

Without doubt, the laser scanner can offer greater precision than many photogrammetric measuring techniques, but its measurement of random dots in many cases also ends up generating a high degree of imprecision, above all regarding precise representation of the clearly defined edges of objects. It is for surfaces without sharp edges that these instruments are clearly of almost unparalleled assistance. An obvious case is that of the frescoes on curved surfaces where the only way of achieving a reliable representation, of dimensions as much as content is by resorting to a 3D textured model.

In the last few years, the lines of research followed show a clear tendency, seen in publications such as the proceedings of CIPA symposiums, to the gradually increasing presence of 3D textured models and the corresponding proportional decrease in line drawings. However, We think the real impact of these techniques on the day-to-day activity of conservation of the architectural and archaeological heritage and to what extent the use of these techniques is having real practical applications and is helping other professionals in their work should be analysed. The traditional representation of architecture by means of plans, elevations and sections continues to be not only valid but indispensable in order to tackle the documentation of this heritage, and even supposing it falls into disuse one day, it will still endure for some time. At least in the meantime, these

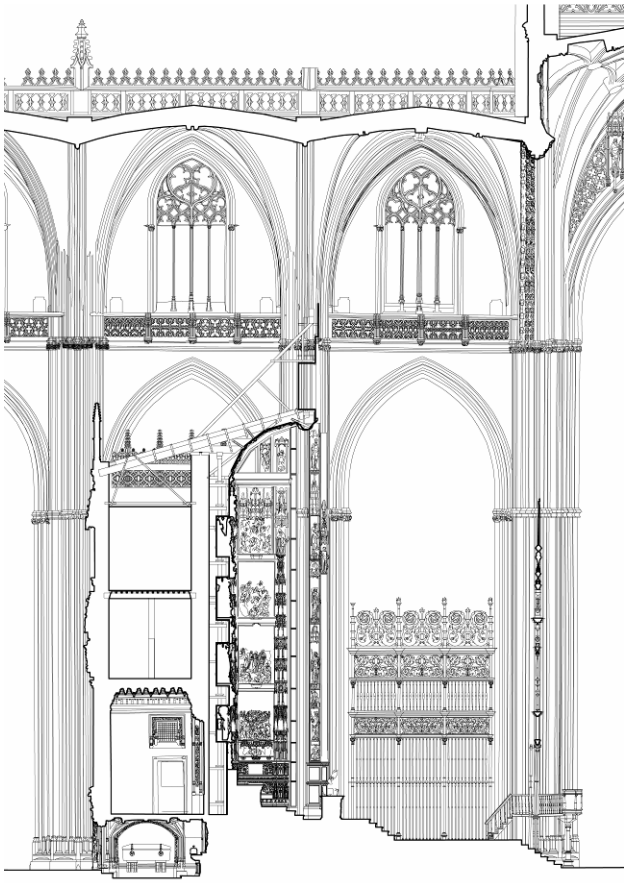

Fig. 6. Detail of the section through the Main Chapel

instruments will continue to be used in the field of architectural design.

In the last years, CIPA has concerned itself more with technological advances and their adaptation to applications in the field of conservation of the heritage than in adequately monitoring the real applications that in practice are made with such advances. I think that without abandoning these activities, one should not neglect the general problems of traditional forms of architectural representation, which continue to be valid and above all necessary.

With respect to this, it become convenient to remember some of the documents produced in the first few years of the Committee's life, especially the one entitled *Optimum practice in architectural photogrammetry surveys* (CIPA 1981), in which, with the vigorous participation of users of the surveys, recommendations and reflections were developed not only about instrumental and technical aspects of photogrammetry but also about the best procedures and requisites for a suitable documentation and representation of architecture. This type of initiative should be tackled anew

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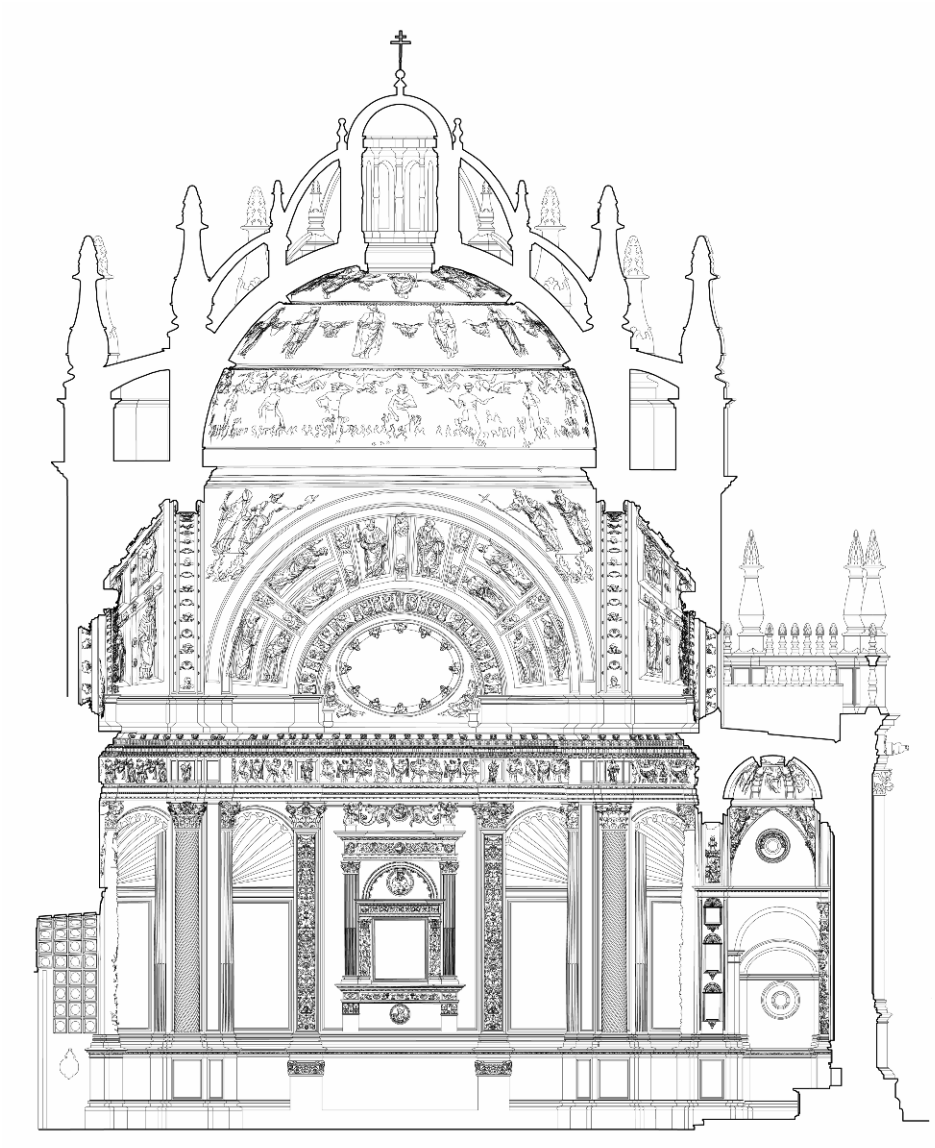

Fig. 7. Cross Section of the Main Sacristy

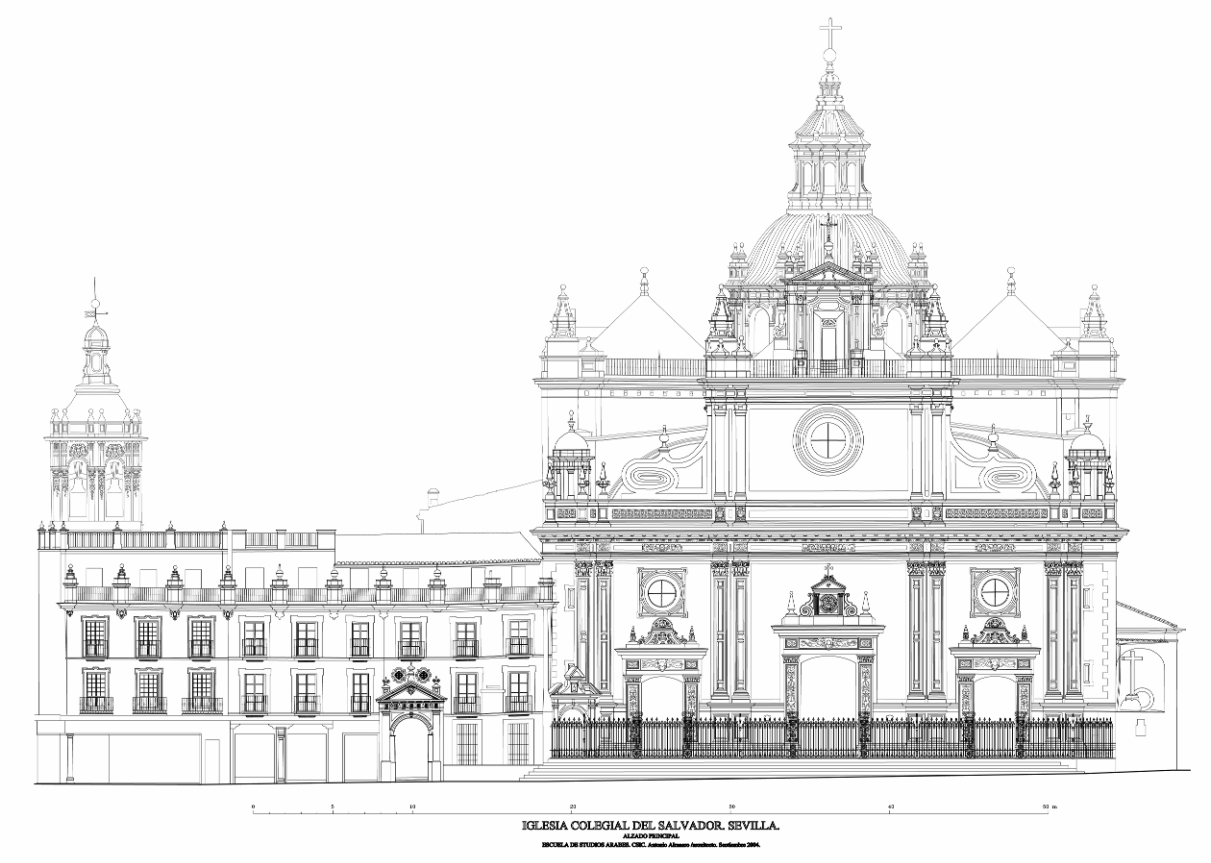

Fig. 8. Façade and section of the Church of El Salvador of Seville