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GRAPHIC DOCUMENTATION AND DIGITAL CHARACTERIZATION OF THE LANTERNS OF THE ROYAL TOBACCO FACTORY IN SEVILLE: FROM LASER SCANNING AND PHOTOGRAMMETRY TO HBIM MODELS

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Abstract

The aim of this research is to make a comparison of the results obtained when carrying out graphic surveys using different systems, with the aim of obtaining models which, in addition to graphically documenting the current state of elements of undoubted architectural value, facilitate their use in heritage intervention. To this end, the skylights on the roof of the former Royal Tobacco Factory of Seville, the current headquarters of the Rectorate of the University, one of the most emblematic buildings in the city due to its heritage and architectural value, have been taken as study elements, with the aim of highlighting their importance, giving impetus to their recovery and conservation.

The aim is to document and highlight these elements using traditional drawing techniques combined with modern methods such, 3D scanning or photogrammetry, to finally obtain a 3D virtual model that, when taken to the BIM environment, generates an integral model that facilitates the analysis of possible conservation works. The current trend is moving towards “smart heritage facility management” (Hou et al., 2020). Integrating HBIM with digital twins enables a transition from reactive restoration to proactive and predictive maintenance (Hartwell et al.,2025). One of the seven original skylights, dating from the mid-18th century, are taken as the object of study.

Keywords: historical heritage; digital survey; BIM; 3D scanning; photogrammetry; lanterns.

Resumen

El objetivo de esta investigación es comparar los resultados obtenidos al realizar levantamientos gráficos utilizando diferentes sistemas, con el fin de elaborar modelos que, además de documentar gráficamente el estado actual de elementos de indudable valor arquitectónico, faciliten su uso en la conservación del patrimonio. Con este fin, se han seleccionado como objeto de estudio las claraboyas del tejado de la antigua Fábrica Real de Tabaco de Sevilla —actualmente sede del Rectorado de la Universidad y uno de los edificios más emblemáticos de la ciudad por su valor patrimonial y arquitectónico—, con el objetivo de poner de relieve su importancia y promover su restauración y conservación.

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Se propone documentar y poner en valor estos elementos mediante las técnicas de dibujo tradicionales alternados con métodos actuales como el escaneo 3D o la fotogrametría, para obtener en última instancia un modelo virtual 3D que, al integrarse en el entorno BIM, genere un modelo completo que facilite el análisis de posibles obras de conservación. La tendencia actual se orienta hacia la «gestión inteligente de las instalaciones patrimoniales» (Hou et al., 2020). La integración de HBIM con gemelos digitales permite pasar de una restauración reactiva a un mantenimiento proactivo y predictivo (Hartwell et al., 2025). Se toma como objeto de estudio una de las siete claraboyas originales, que datan de mediados del siglo XVIII.

Palabras clave: patrimonio histórico; catalogación; BIM; escáner 3D; fotogrametría; linternas

1. A HISTORICAL AND CONSTRUCTIVE ANALYSIS OF SKYLIGHTS AT THE FORMER ROYAL TOBACCO FACTORY IN SEVILLE. CONTEXT AND JUSTIFICATION

The Seville Tobacco Factory, now home to the University of Seville's Rector's Office, is an 18th-century industrial building regarded as one of Europe's most outstanding structures due to its scale and architectural significance. Its location outside the city walls, its rectangular layout and its ability to adapt to different uses over time make it a unique example of industrial heritage and architectural regeneration.

The existing skylights at the Royal Tobacco Factory in Seville are of great historical, artistic and aesthetic interest, yet remain unknown to the public due to their location and inaccessibility. The aim of this research is to obtain up-to-date graphical records using modern technologies to create a three-dimensional virtual model that goes beyond the visual perception offered by traditional dihedral planimetric drawings. It is anticipated that, in addition to facilitating a comprehensive and realistic architectural analysis, the resulting model can be used for various purposes such as supervision, conservation, restoration, monitoring, management, simulation, dissemination, etc.

The Royal Tobacco Factory of Seville, which currently houses the University Rectorate, is one of the most emblematic buildings in the city of Seville, owing to its heritage and architectural value at both European and national levels, from the 18th century to the present day. The Royal Factories originated in France, specifically during the long reign of Louis XIV, driven by his Prime Minister, Jean-Baptiste Colbert, and were introduced to Spain with the arrival of the Bourbons, under Philip V. It did not take long for tobacco to become a common practice among Europeans who had emigrated to the New World. Barely a few decades after its discovery in the early days of the Age of Discovery, it was already being consumed by many of the new arrivals.

The building is rectangular in shape, measuring 185 by 147 meters, and is surrounded by a wide moat, except for the main façade, which runs along the longest side. The building was constructed by first excavating the entire site to a depth of –3.05 m below the current ground level (González-García & González-Vílchez, 2014). The enormous roofs were designed specifically for their purpose: the curing of tobacco. This objective was achieved thanks to the high parapets; the height of the parapet prevented the leaves from being scattered by the wind. One of the most spectacular features of this roof are the nine skylights it contains.

There are seven different beautifully designed models, which were used to provide lighting for the rooms in the galleries on the main floor.

The lanterns resemble Sevillian Baroque, with late Baroque features and a transition towards the academic 18th-century Baroque style characteristic of the Tobacco Factory of the mid-18th century. The interior plasterwork of L7 explicitly references 17th-century Sevillian Baroque plasterwork (the Tabernacle of the Cathedral, Santa Caridad, Santa María la Blanca), suggesting a clear connection to Sevillian decorative Baroque. The stone lanterns (L1, L2, L3 and the central elliptical one) feature a more restrained composition, close to the Bourbon academic Baroque, with classical overtones.

The ceramic lanterns (such as L7), with a hexagonal plan, featuring indigo-glazed tiles and crowning vases, are reminiscent of the most

Table. 1. Classification of lanterns by type, style and construction materials. Original work.

Lantern	Type	Style	Main materials
L1	Stone	Academic Baroque	Stone, including calcarenite and limestone
L2	Stone	Academic Baroque	Stone, including calcarenite and limestone
L3	Stone	Academic Baroque	Stone, including calcarenite and limestone
L4	Ceramics	Exuberant Sevillian Baroque	Brick, mortar covering, polychrome/glazed tiles
L5	Ceramics	Exuberant Sevillian Baroque	Brick, mortar covering, polychrome/glazed tiles
L6	Ceramics	Exuberant Sevillian Baroque	Brick, mortar covering, polychrome/glazed tiles
L7	Ceramics	Exuberant Sevillian Baroque	Brick, polychrome/indigo blue tiles, ceramic finishes
Undated 1	Ceramics	Exuberant Sevillian Baroque	Brick, polychrome/indigo blue tiles, ceramic finishes
Undated 2	Stone	Academic Baroque	Stone, including calcarenite and limestone

exuberant Sevillian Baroque style, linked to the tradition of tile-making and an ornamental style that became popular in the second half of the 17th century and the first half of the 18th.

We will now discuss the construction methods and materials used in the construction of the lanterns at the Antigua Real Fábrica, taking into account the construction techniques typical of 18th-century Sevillian Baroque, to address the construction of small-scale skylights and domes.

The Baroque is a dynamic, lively, anti-static art form; it represents the transitory nature of life, the fleeting and the ever-changing.

Its predominant materials are brick and stone, with glazed ceramic tiles and plasterwork serving as decorative elements and finishes.

We shall designate the skylights using the following terms: L1, L2, L3, L4, L5, L6 and L7 to refer to the skylights shown on the reference plan (Fig. 1).

They can be divided into two categories, distinguished by area and materials used.

The first consists of high-quality materials and is located in the palace area, where there are three skylights constructed from stone.

The second category comprises the remaining skylights, which are scattered across the roofs of the former industrial area and are made entirely of fired ceramic tiles; ceramic material was more abundant and less expensive than stone.

We find skylights constructed using standard ashlar masonry, that is to say, they exhibit relative uniformity, with the primary dimension being the thickness of the stone. Furthermore, it is evident that the heights of all the ashlars are consistent, which allows us to describe the masonry as regular.

In skylights L1, L2 and L3, we see a distinct stone composition, as two types of stone are used for the side structural elements: calcarenite and limestone.

However, the central skylight, which has an elliptical plan, is constructed solely from limestone, a material of higher quality and greater durability.

We might assume a preference for this material, or a shortage of materials during the construction process. Even the ornamental carving of the stone differs between them.

In the second case, the body of these structural elements—hexagonal in plan and inscribed within

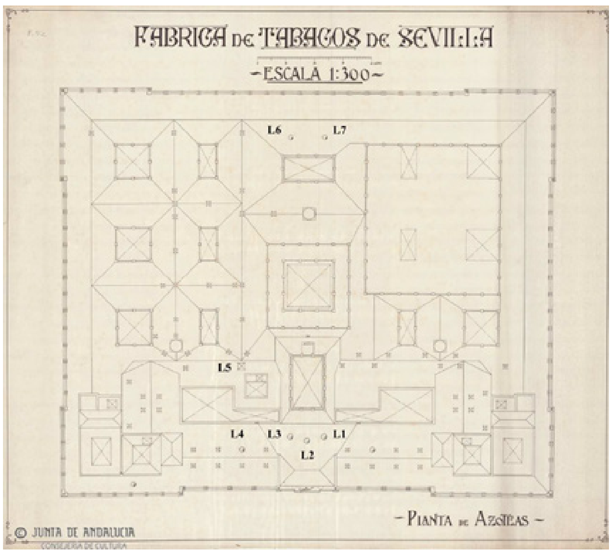

Fig. 1. Floor plan of the roof of the Royal Tobacco Factory in Seville. Source: AHPSe, Seville Tobacco Factory collection.

Fig. 2. L7 lantern from the Royal Tobacco Factory in Seville. Photography by the authors.

circles of varying diameters—is constructed of bricks, finished with a mortar render and topped with glazed ceramic tiles.

Constructed mostly of ceramic pieces, they feature glazed ceramic finishes in shades of indigo.

With a similar aesthetic pattern, they feature ceramic crowning elements in the form of ornate vases of the same proportions.

We will now examine one of the most characteristic lanterns, designated L7 (Fig. 2.), located in the south façade bay.

Its interior is finished with a continuous plaster coating, accompanied by beautiful plasterwork ornamentation; these decorative elements allude to 17th-century Sevillian Baroque plasterwork, with glazed ceramic tiles and ceramic vases crowning the dome.

It should be noted that the new Baroque style appeared in Seville from the 1650s onwards, developing in three highly representative buildings: the Tabernacle of the Cathedral and the churches of the Hospital de la Santa Caridad and Santa María la Blanca (Recio, 1994).

An archive image is shown (Fig. 3), which displays a small freehand sketch of the architectural element, to provide a brief measurement of its components and an estimated budget in pesetas.

2. METHODOLOGY

To achieve this objective, we propose comparing traditional surveying techniques with new methods, such as those based on 3D laser scanning or photogrammetry, to ultimately obtain a virtual model. When integrated into a BIM environment, this model generates a comprehensive representation that facilitates analysis during restoration works, subsequent preventive maintenance tasks, management, and the promotion of existing heritage. The use, therefore, of new technologies such as 3D laser scanning in heritage conservation and restoration work (Rodríguez-Moreno et al., 2018), following established protocols (Simeone et al., 2019), is of great assistance in carrying out the actual geometric survey and volumetric analysis of the architectural element through the generated point cloud.

This point cloud generates a BIM model (Volk et al., 2014), in which the elements to be replaced are virtually identified and defined (McArthur, 2015) and enables their use in applications for multimedia devices and the subsequent realistic display of the resulting models (Natephra et al, 2017).

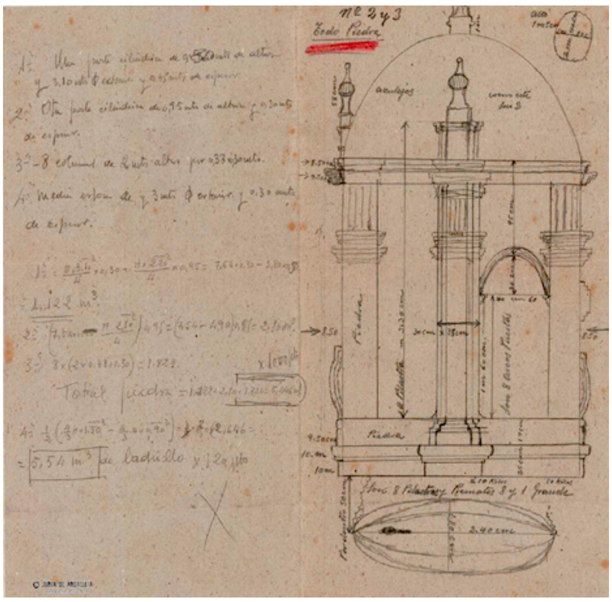

Fig. 3. Sketch, measurements and cost estimate for a lantern. Source: AHPSe, Seville Tobacco Factory collection.

The use of supervoxels to improve point cloud segmentation in historic buildings with non-uniform densities, would help to better define architectural features (Salamanca et al., 2024).

The 3D scanning techniques and methods discussed in the existing scientific and industrial literature (Daneshmand et al, 2018) offer a wide range of possibilities; consequently, some of these have been implemented in this study. The planimetric survey of the lanterns has focused on three methods: Traditional, Photogrammetric and Laser Scanning, from which the BIM methodology is applied to obtain the virtual 3D model.

The integration of TLS (Terrestrial Laser Scanning) and photogrammetry is currently the fastest-growing area of research for maximizing accuracy and spatial coverage (Yang et al., 2020).

The various phases were as follows:

- Fieldwork over several visits: involving data collection using traditional methods (measuring tapes, etc.), photogrammetric methods (sequenced photographs), and 3D laser scanning.
- Office-based work: to develop 2D and 3D graphical representations based on the data obtained by the different systems.
- Definition of final models based on the method used and its graphical options.

2.1 CONVENTIONAL METHOD

The need to obtain the necessary data requires the involvement of qualified technicians with expertise in this type of survey, to ultimately produce 2D drawings comprising floor plans, elevations and sections. It is obvious that the ornamental complexity of the architectural element makes it essential to distinguish between the theoretical forms and those inherent to the volumetry of the object under study.

The various sketches with dimensions were carried out on site, due to the lack of existing graphic documentation of these architectural elements, with the aid of a couple of tape measures, a laser distance meter and drawing tools.

To understand this architectural feature in greater detail, a survey has been carried out in two dimensions of the L7 lucernary, using computer-aided design software (AutoCAD). Below are one of its elevations, a section and a cross-section of the lantern.

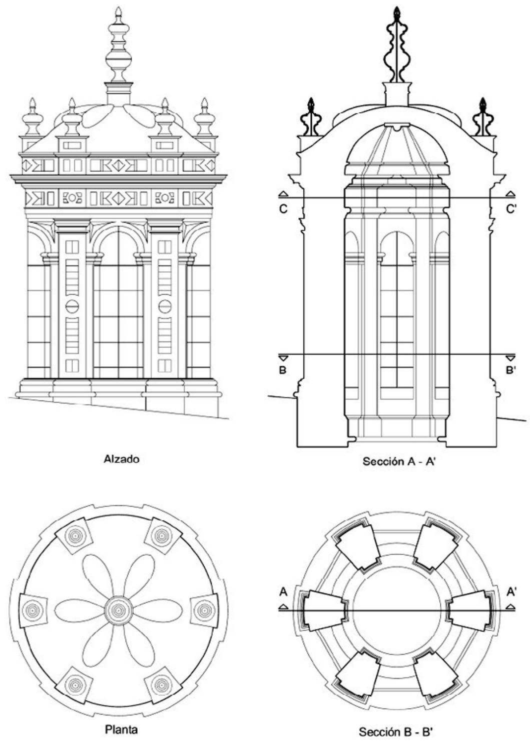

Fig. 4. CAD floor plan of the lantern L7. Royal Tobacco Factory. Original work.

The lanterns feature harmonious internal proportions—hexagons inscribed within varying circles for the ceramic ones (L4–L7), symmetrical elliptical ones for the stone lanterns (L1–L3)—which, on the scale of the colossal building (185 x 147 m), act as lighting elements of modest scale, faithful to the Sevillian Baroque style, as can be seen in the image (Fig. 4).

2.2 PHOTOGRAMMETRY

Architectural photogrammetry can be defined as “the technique that enables the geometry and dimensions of an architectural object to be reconstructed using a set of photographs taken of it.” (Astorqui, 2003).

This makes it possible to generate accurate three-dimensional models, considering permissible errors in data processing, as well as a planimetry that closely matches the reality of the built structure (Cámara & Latorre, 2003), through the application of mathematical models, including in panoramic images (Luhman, 2010). All of this makes this system a powerful tool for the analysis and assessment of architectural heritage.

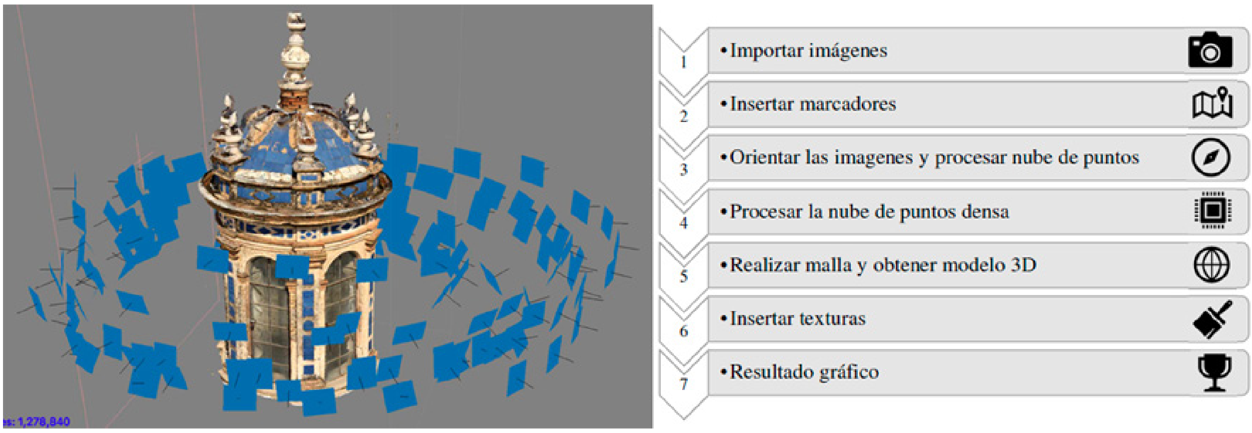

Fig. 5. Photogrammetric survey and workflow. Original work.

Agisoft PhotoScan Professional processing software with an educational license was used, applying the workflow shown in the image (Fig. 5). To develop this technique, the L7 lantern, constructed from brick, was selected due to its rich color palette, and over 100 sequential photographs, each overlapping by 70%, with an image resolution of between 4500 and 5500 pixels and a shooting distance of between 3 and 5 meters. were taken to obtain a reliable model. To implement the method, markers or control points (Forlani et al., 2014) have been manually placed, serving a dual purpose.

First, they provide the software with information on the location of points shared between the different images, and on the other hand, they form the basis for the program to perform camera orientation and model scaling, with numerical values needing to be established to define the distance between the different control points. In this way, the programme can establish a relationship between distances and coordinates for the different points.

This photogrammetry method is widely used in the processing of images captured by unmanned aerial vehicles (UAVs) (Tahar, 2013). The process continues by creating so-called ‘masks’ on the photographs, which serve to optimize the software’s processing of the images. Created manually, they are essential for hiding certain areas and excluding them from the processing. In other words, we delineate the images, thereby removing all elements that do not contribute information to the survey, such as the sky, the ground, surrounding vegetation, and other objects that are not part of the three-dimensional model we wish to obtain. The masks will remove the shaded areas from the images. As this involves manual delimitation and the process must be carried out on each individual photograph to be processed, it is quite a laborious task. Nevertheless, given the high quality of the final result, it is an essential step if we want to achieve the best possible outcome.

Once the masks have been completed, the dense point cloud is processed to ensure that the result obtained is of the highest quality. It should be noted here that, to speed up all these steps, it is advisable to carry them out on a computer with high graphics and processing power.

The next step is the creation of the mesh (Ribó et al., 2002), based on the dense point cloud created previously from which we will obtain a colored mesh, a solid mesh and a final mesh created by triangulation. There is current literature relating to mesh processing in architecture (Hua, 2014). The final step, once the colored mesh has been obtained, is texturing (Fig. 6. Point cloud, dense mesh and textured mesh. Original work.).

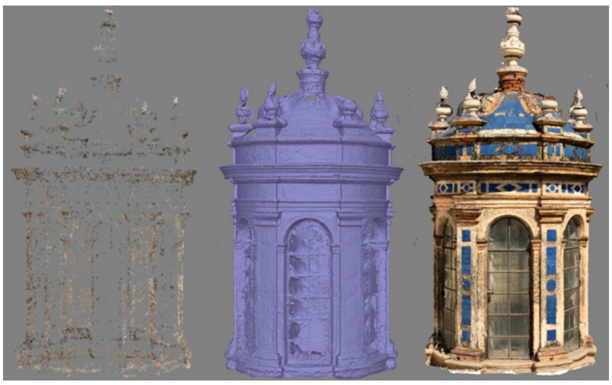

Fig. 6. Point cloud, dense mesh and textured mesh. Original work.

2.3 3D LASER SCANNING

The use of 3D laser scanners in architectural surveys of heritage buildings is widely documented and practised (Zlot, 2014; Tomljenovic et al., 2015; Ebrahim, 2016), and provides us with a point cloud that can be exported as a reference precise geometry, into CAD/BIM software, where we can create cross-sections to develop a solid model that matches, as closely as possible, the geometry of the analyzed element (Hichri et al., 2013).

The process involves the sequential use of the Leica ScanStation C10, Cloud Compare to post process the point cloud, Recap Pro and, finally, Revit software.

The Leica ScanStation C10 is a time-of-flight terrestrial laser scanner (TLS) that stands out for its all-in-one design (combining scanner, controller, battery, internal memory and camera). It offers 3D positional accuracy of 6 mm at 50 metres, single-point positional accuracy of 4 mm and spatial resolution of 4.5 mm at 50 metres.

After analyzing the possible locations for the equipment, five positions were identified that would allow us to capture the volume of four of the lanterns in the study area: L1, L2, L3 and L4.

Once the laser scanning had been carried out at each stationing point, photographs were taken using a 360° panoramic camera, without moving the tripod, to link the point cloud (in black and white) with the captured images (in color), thereby obtaining the color range of the points comprising the cloud.

The different point clouds obtained at each of the five survey points were registered (merged) using Cloud Compare software, resulting in a point cloud that encompasses the entire dataset, as shown (Fig. 7). Autodesk Recap Pro was then used to carry out the data conversion process known as indexing, which involves importing the files from the laser scanner. At the start of this process, we can choose the number of points to import that we wish to work with in Recap Pro®, and we can also adjust various parameters to improve the final quality of the point cloud.

Once the point cloud has been imported, the file is edited to remove any unwanted elements, either by hiding or deleting them. Following an assessment carried out after the laser scanning survey, it was decided that Lantern L1 would be selected for modelling using the BIM methodology, as this would also provide the model for Lantern L3, given that they are twin lanterns. In this project, all redundant points have been removed to ensure that only the points comprising the volume of the selected L1 lantern are displayed.

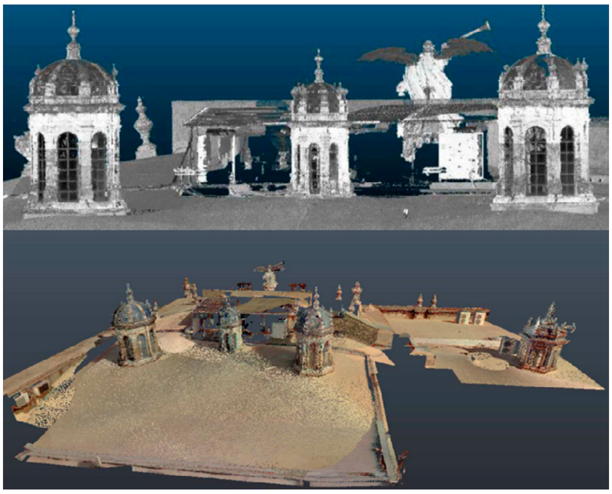

Fig. 7. Point cloud editing using Cloud Compare and Autodesk Recap Pro. Complete point cloud. Original work.

2.4 BIM METHODOLOGY

Once the dimensions, plans and volumes have been verified using the three methods described above, the decision is made to create the BIM geometric model using Autodesk Revit software, into which we can import both the 2D plans previously created in AutoCAD and the point cloud obtained via photogrammetry or laser scanning. To do this, in addition to being familiar with the existing CAD exchange formats, it is also necessary to be familiar with the data exchange formats for point clouds (Landa et al., 2013).

These semantically enriched HBIM models can be integrated into game engines such as Unreal Engine 5 (Kim & Lee., 2025) to create detailed virtual reconstructions that facilitate cultural outreach. You could also discuss the use of Extended Reality (XR) (El Barhoumi & Hajji, 2025) as a tool for cultural mediation that enables historical narratives to relate to contemporary audiences.

Any of these inserted graphic elements can serve as a reference when modelling elements in Revit, and in this study, it has been considered

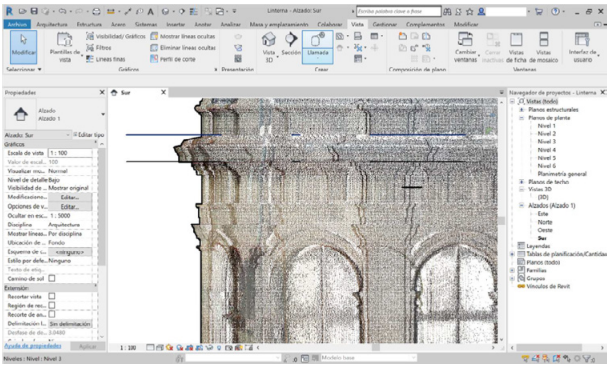

Fig. 8. Insertion of a scatter plot and definition of levels. South elevation view. Original work.

that the most reliable of those obtained, due to its millimeter-level precision, is the point cloud obtained by laser scanner. It provides data in perspective views, and in the six dihedral views and sections parallel to them, which are of interest.

Therefore, the point cloud of the L1 lantern previously obtained using ReCap Pro® (Fig. 8) has been imported into the project; this behaves as a three-dimensional solid object, similar to a surface made up of points, and can be moved freely within the interface, as well as having its visibility toggled on or off. No changes can be made to the graphical parameters of this imported reference model, whether they be lines, surfaces or any other element that makes up its spatial volume.

The levels required for the planimetry are determined based on the point cloud reference, first generating, in plan view, the reference ellipsoidal guideline for the positioning of the columns. Revit operates using families within which we can define, in addition to appearance and geometric constraints, the parameters required by the various objects. For this reason, the different families required to assemble the L1 lantern assembly have been created separately.

The first step was to generate the outer contour of the ellipse so that it matched the existing distortions in the L1 lantern as closely as possible. The aim here is to achieve an ideal model with the greatest possible resemblance.

Next, the connecting elements between the pilasters are drawn, with lines on vertical planes, using the sweep tool that follows the path of the ellipse. It should be noted that the geometric complexity of the elements requires knowledge of geometric drafting and the use of CAD software when working in 2D planes to establish the profile along which the sweep is performed. Furthermore, the pillars exhibit different curvatures depending on their position along the elliptical guideline and their actual axes; consequently, four of them had to be created to be as consistent as possible with reality, with the final four being generated using symmetry.

Finally, the dome was modelled, treated as having the outline of a perfect ellipse, and a surface grid was adapted to allow the insertion of textures with a finish like the existing glazed ceramics, albeit with some distortions (Fig. 9).

LOD 200 (Schematic): Elements feature approximate quantities, sizes, shapes, and

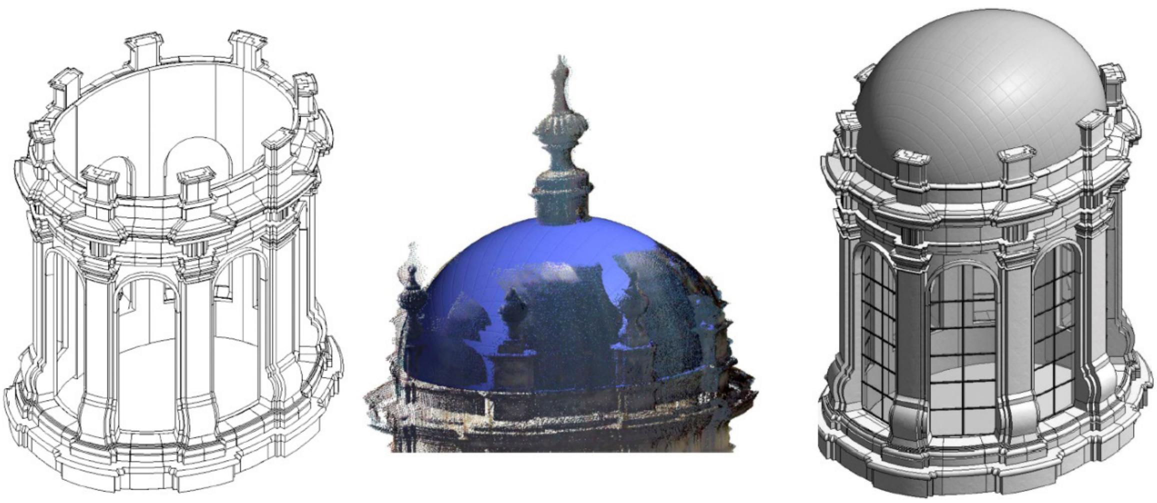

Fig. 9. Connection of columns and dome layout. Original work.

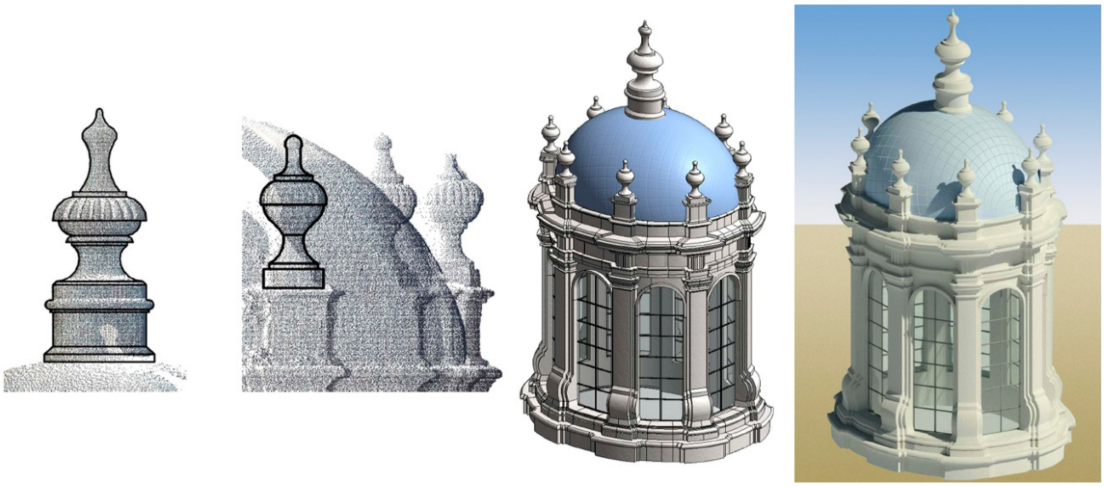

Fig. 10. Layout and insertion of final decorative elements, showing the final result. Original work.

locations. It is used for initial spatial analysis and high-level budgeting. The resulting idealized model is created at a Level of Development (LOD) of 200 (Schematic), where elements are represented with approximate quantities, sizes, shapes and locations. It is used for initial spatial analysis and high-level budgeting, with an .ifc exchange format.

Finally, the process concludes with the creation of the ornamental elements, which, once inserted into the model, allow for rendering (Fig. 10).

3. RESULTS AND DISCUSSION

The results obtained can be considered satisfactory, bearing in mind that the main

Table 2. Comparison table of the three methods used (Manual, Photogrammetry, 3D Laser Scanning/BIM) in terms of data collection time versus processing time, accuracy achieved, and the level of architectural detail captured. Original work.

Method	Data acquisition time	Processing time	Achieved accuracy	Ornamental detail captured
Manual survey	High, as on-site measurements require direct access, careful observation, and repeated checking by the operator.	Moderate to high, since CAD drafting and geometric interpretation require substantial post-fieldwork reconstruction.	Centimetre-level, with accuracy strongly dependent on operator expertise and the geometric complexity of the object.	Low to moderate: it captures overall geometry, but tends to miss fine mouldings, subtle distortions, and highly intricate decorative features.
Photogrammetry	Moderate, because image acquisition is relatively fast, although it requires full coverage, adequate overlap, and controlled shooting conditions.	High, due to the need for image masking, dense cloud generation, mesh construction, and manual verification.	High, generally within centimetre to sub-centimetre ranges, although dimensional checking is required to compensate for optical distortions.	High: it records textures, material appearance, chromatic variation, and visible ornamental elements with strong visual fidelity.
Laser scanning	Moderate, since field capture is efficient but depends on scan station planning and accessibility.	Moderate, as point-cloud registration, cleaning, and import into modelling software are time-consuming but methodologically direct.	Millimetre-level, especially reliable for external geometry, sections, and dimensional control.	Very high in geometric detail: it is particularly effective for mouldings, edges, relief, and volumetric deformation, although it does not capture colour or surface texture as fully as photogrammetry.

objective was to implement new technologies in heritage conservation work, with the aim of promoting the restoration, conservation and promotion of the heritage of the Royal Tobacco Factory in Seville.

Using photogrammetry, a three-dimensional model suitable for virtual reality applications has been created, allowing the public to view these skylights via computer or multimedia devices, as their location makes direct viewing impossible. This model provides a realistic visualization of the state of conservation on the date the photographs were taken, enabling subsequent monitoring for maintenance purposes, or serving as a graphical database for analysis should intervention be required.

Regarding 3D laser scanning, it should be noted that it produces a more accurate model of the existing external geometry, which serves as a reliable basis for subsequent BIM modelling.

The BIM methodology has produced an idealized geometric model, as it does not fully and reliably reflect any deterioration or loss of surface material, but it does provide comprehensive floor plans tailored to specific requirements.

The integration of point clouds and sensors into Digital Twin environments has been shown to reduce the root mean square error (RMSE) by 33% compared to conventional BIM methods (Hartwell et al., 2025). It also discusses how automation using Deep Learning is streamlining data processing (Zhang et al., 2025), although its application to complex heritage geometries remains a challenge.

4. CONCLUSIONS

The lanterns of the former Royal Tobacco Factory in Seville, the main subject of this study, reveal significant heritage value through the integration of advanced technologies that go beyond traditional surveying methods. Their geometric and volumetric analysis, obtained through photogrammetry, 3D laser scanning and BIM modelling, enables precise conservation and virtual dissemination, highlighting harmonious proportions (hexagonal/elliptical) scaled to the monumental building.

Technological advantages:

- Photogrammetry offers rapid and cost-effective three-dimensional models with high geometric accuracy, ideal for virtual reality and conservation monitoring, although they require manual verification of dimensions due to optical distortions
- 3D laser scanning provides point clouds with millimeter-level precision, a reliable basis for BIM, despite the occasional need for aerial means at great heights.

Implications for restoration:

- BIM modelling generates idealized geometries with material parameters, facilitating floor plans, preventive maintenance and analysis of deterioration in these small-scale Baroque Sevillian lanterns.
- This comprehensive approach not only drives the recovery of the roof's hidden heritage but also enables its management and multimedia dissemination.
- The long-term preservation of 3D assets requires adherence to the FAIR principles (findability, accessibility, interoperability and reusability) to prevent the technological obsolescence of files (Amico & Felicetti, 2024). Models generated for the lanterns must be accompanied by detailed metadata and paradata (such as the STARC standard) that document not only the geometry, but also the creation process and the history of the object.

The results confirm that documenting the lanterns requires a combined approach. Manual surveying provides interpretative control, photogrammetry enhances visual and ornamental interpretation, and laser scanning delivers the most reliable metric accuracy. Consequently, the integration of methods not only responds to a current methodological trend, but also to the specific need to faithfully document elements with complex geometry, rich ornamentation and difficult access, ensuring their usefulness for analysis, conservation and BIM modelling.

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