“New methods for documentation and analysis in building archaeology -prestudy”

A project funded by the Swedish National Heritage Board, R & D funds

Agostina Appetecchia, Olof Brandt, Hanna Menander, Håkan Thorén
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Introduction

“New methods for documentation and analysis in building archaeology” is an international research project in cooperation with the Swedish National Heritage Board, Archaeological, Contract Archaeology Service, UV, The Pontifical Institute of Christian Archaeology in Rome, The Swedish Institute in Rome and the Vatican Museums. The project was funded in 2011 by the Swedish National Heritage Board:s R & D funds. The overall purpose of the project is to develop new procedures and methods for documentation, analysis, interpretation, reconstruction and communication of results from the building archaeological surveys. The long term goal is to develop and strengthen the building archaeological perspective so that in the future it forms an integral and important part of cultural resource management. The goal of our studies is also to generate a deeper knowledge and a result that brings life to the buildings and the people who used them.

In September 2011, we conducted a three-dimensional documentation of the Lateran baptistery in Rome. The work was done with a laser scanner, but also with digital camera, where a new method called "structure from motion" or "photo scanning" was used. The results from this year’s work imply that we have found methods and techniques for a quicker, cheaper and qualitatively better form of documentation for building archeology. Furthermore, the project has resulted in that we now have a three-dimensional model of the baptistery which enables new forms of analysis, interpretations, but also that new questions can be activated.

Previous studies

The present project is the continuation of the studies of the standing structures of the Lateran baptistery, which began in 1997-1998 (Brandt 1997-1998). Archaeological research on the baptistery began already in 1924 but concerned only the foundations and the excavations beneath and around the standing building.

The first excavations were made inside the baptistery in 1924 and in the vestibule in 1925-1926. These excavations revealed remains of a Roman third-century complex which had been demolished for the construction of the baptistery, and the foundations of the octagonal fourth-century baptistery. The observation that the octagonal building’s foundation was circular led to the conclusion that the first phase of the baptistery was of circular shape (Giovenale 1929). This had a deep influence on all further scientific discussion of the building. The first phase is of particular historical importance since it is attributed by ancient sources to the Emperor
Constantine, which makes it the oldest known monumental building for Christian baptism.

The conclusion that only the foundations remained of Constantine’s baptistery diminished the interest for the still standing building, which was attributed to the Popes of the fifth century.

New excavations outside and around the baptistery in 1962-1964 uncovered other parts of the third-century complex which had already been found inside the baptistery in the earlier excavations. These new excavations did not lead to different conclusions regarding the first phase of the Christian building (Pelliccioni 1973).

Only after the end of these last excavations, in 1966, the plaster which had covered the outer walls of the building was removed, revealing the late antique brick walls with many traces of reconstructions and repairs, like for
Fig 2. Plan over the Lateran-area. The baptistery is marked with number 17 (From Brandt & Guidobaldi 2008:191).
example ancient doors and windows which had been closed in later phases. A scholar like Richard Krautheimer, the most important expert on the early Christian churches in Rome, noticed already in 1969 that the standing walls could belong to Constantine’s original phase (in Krautheimer 1993, 142), but for a long time these ancient wall surfaces were not studied in depth. The publication of the 1962-1964 excavations concerned almost only the remains beneath floor level. Although some documentation of standing structures were presented in the publication, there was no organic analysis of the building.

A new examination of the foundation walls 1993-1996 revealed that the circular foundation must belong to the same phase as the octagonal brick building (Brandt 1997-1998). This conclusion made it inevitable to consider at least part of the standing walls as parts of Constantine’s original phase. The same study contained also the first observations of the stratigraphy of the standing walls.

An in-depth study of the visible ancient wall surfaces was begun in 2005 and continued in 2006 and 2008 in a project centered upon a two-dimensional documentation and analysis of the visible wall surfaces. This study led to the production of AutoCad drawings of stratigraphic wall analysis based upon rectified photos. Some preliminary results were published in 2008 (Brandt & Guidobaldi 2008) and in 2010 (Brandt, 2012). The present project, centered upon three-dimensional documentation and analysis, is the fruit of the methodological experience acquired in the project initiated in 2005.

**Overall building phases**

Today the Lateran baptistery appears essentially as it was left after some reconstructions by 16th and 17th century popes. They chose however to leave the complex in the late antique and medieval shape, modifying essentially its decoration, roof and windows. It seems that the elaborate architecture of the baptistery inspired more respect than other important buildings erected by the Emperor Constantine in Rome, like the Lateran basilica, which was heavily modified in its structure in the 17th century, and the basilica of St. Peter, which was completely demolished in the 16th century.

The medieval complex consisted of a central, octagonal hall, partially belonging to the original phase of the Emperor Constantine in the early fourth century, surrounded on five sides by other chapels and other buildings added in the fifth and seventh centuries. The original fourth-century baptistery was an octagonal building with doors on almost all sides and small, arched windows above the doors. The shape of the roof is not known. To the east, the baptistery was connected to a rectangular hall of unknown function.

Recent research (Brandt & Guidobaldi 2008) has reconstructed the phases of the extensive fifth-century reconstruction, which lasted for several decades. The upper part of the walls of the octagonal hall was added with higher and bigger windows, while the old windows were closed. An internal circular colonnade with eight huge columns carried a second smaller

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**Fig 3. Plan over the baptistery (with letters on each façade). Made by Olof Brandt (Brandt & Guidobaldi 2008:228).**
colonnade which probably carried a dome. Recently (Brandt 2012) it has been suggested that the outer walls were slightly lower than today and that the circular corridor surrounding the colonnade originally was covered by a roof, while the central space was illuminated by windows beneath the central dome. In a later phase, which is difficult to date, the outer walls were raised to their present height, and the circular corridor may have been covered by a circular vault. Most surrounding buildings were added in the fifth century reconstruction: a vestibule to the southeast, two small cruciform chapels to the southwest and northeast (San Giovanni Battista and San Giovanni Evangelista), and to the northwest a portico which connected the baptistery to another cruciform chapel (Santa Croce). Of these chapels only that of San Giovanni Evangelista is preserved in its ancient shape: that of San Giovanni Battista was rebuilt in oval shape in the 18th century, and the chapel and portico of Santa Croce were completely demolished in the 16th century.

In the 7th century, the hall to the east was transformed into the chapel of San Venanzio, which is still preserved in its medieval shape.

The Renaissance reconstructions begin in the early 16th century with the reconstruction of the roof of the circular corridor inside the baptistery and of its central dome. In the late 16th century the complex of Santa Croce is demolished. In the early 17th century, the inner colonnade is restored and its upper columns are replaced. Its bases and capitals are restored, and a new dome is built. Towards the middle of the century the ancient marble decoration of the inner walls is replaced by plaster with frescoes illustrating the life of Constantine. After the 18th century reconstruction of the chapel of San Giovanni Battista, no important reconstructions are made before the extensive restoration work in the 1960-ies, when the plaster is removed from the outer walls, leaving uncovered the late-antique brick walls which are among the main objects of study in the present project.

**Project background, aims and objectives**

Building archaeology and the building archaeological research field in Sweden has partly stagnated mainly due to the lack of investigations but also because the resources often are very limited. Another contributing factor may be that standing buildings' statutory protection in practice is relatively insignificant. This is particularly evident in connection with for example restorations as it is only in exceptional cases that there exists a demand for a building archaeological investigation, although the effect on the masonry can be relatively large-scaled. The consequence of not doing a qualified archaeological documentation is that information and knowledge which is important for understanding the history of the building are forever lost. The antiquarian way of handling these matters (i.e., that rarely no building archaeological investigation are done) appears even more problematic and inconsistent when compared to buildings that are below ground. When buildings are found on archaeological excavations, it is obvious that they are subject to the same requirements for reliable and high-quality documentation as the rest of the archaeological remains found in the excavation.
There is certainly a difference in the sense that structures found beneath the ground, on archaeological sites, often are removed. But in practice a restoration of a building above ground, such as for example changing the plaster, often means that older building phases are removed or covered. There is thus a contradiction between how the antiquarian point of view considers the historic value of a building above and below ground. A more rigorous approach should instead be that all buildings, regardless of how they relate to today’s ground level, should be considered as historical documents whose origins can be researched and told through building archaeological surveys.

That building archeology has ended up in the backwater and now unfortunately only forms a small and relatively immaterial part of the cultural heritage management also depends on the quality of many of the building archaeological surveys carried out. They quite often only include a presentation and dating of distinct building phases of the masonry. The investigations have been and are often documentation oriented and too seldom they generate or communicate knowledge which is relevant to the community.

Today, there is also some confusion because different actors in the cultural heritage management use and above all define the word building archeology in various ways. The term is often used among architects and building antiquarians but also by others in the sector, as a term for a method of restoration. Regardless of how the concept of building archeology is used and by whom, it is of the utmost importance in this context to emphasize that we refer to an archaeological approach and to the application of archaeological methods to buildings by trained archaeologists.

For building archeology, digital technology has meant new opportunities to further develop methodologies for both documentation and new types of analysis. By using three-dimensional documentation techniques such as laser scanner, it is possible to create models and “whole” rooms, which means that the building’s spatial articulation and usage and how this has changed over time can be discussed in a more profound way than before. Furthermore, the documentation has great potential to be processed into visualizations and representations of the building which can be used advantageously in order to convey the building’s history. Gunhild Eriksdotter has in her thesis, “Bakom fasaderna” formulated a three-part analysis model for how to work with buildings to visualize time, space and the use of the building (2005). In this context it is enough to emphasize the latter aspect, the users, which is an interesting and worthwhile way of giving life to the building and its function. By using this perspective, the experience of the room and the building can be discussed by making some elements of the architecture and decoration visible and activate them with meaning. That is to say that you are looking for markers that had a specific meaning to the viewer. The purpose of the markers has been to manipulate and control the viewer’s, ie the user’s, experience of the room. By searching for these markers, interpret and read their codes and try to understand the impact they have had for the viewer and the purchaser we can get closer to the people, the occupants of the room. This kind of empathic analysis, that actually treats the rooms’ intellectual properties, has therefore great potential to draw attention to the
people but also to the client’s intentions and the interaction between the building and the people who used it. Analyses and simulated experiences of this kind can easily be performed in virtual models where selected visual positions can be reconstructed and visualized (Eriksdotter 2005, 2009). A three-dimensional documentation makes this type of analysis easier and can advantageously be a first step.

The building archaeological perspective’s relevance to cultural heritage management apparently needs to be emphasized and its role in the cultural heritage needs to be clarified. In order to increase its relevance we need to broaden the perspectives and recurrently discuss which questions can be directed to the source material and how these can be related and communicated to the research-field and to the society. Building archaeology has to change focus to become more relevant, both for cultural heritage management in general but also for current users of cultural heritage. We need to develop our results and above all develop the communication of our results. This requires that we develop and discuss new methods, analysis and issues but also that we seek dialogue and discussion with researchers and practitioners in other countries but also in related disciplines. In order to draw up new guidelines for building archeology a research project is needed, a building archaeological experimental laboratory, where new methods, approaches and issues can be tested, evaluated and discussed.

Against this background and this need the research project “The Lateran Baptistery in three dimensions” was initiated in 2008/2009 with the aim to develop and test three-dimensional documentation methods. An important aspect of the project was also to create a platform for Swedish and Italian building archeologists. In 2010, a pilot study funded by Gihls Fond was carried out in which parts of the Lateran baptistery in Rome was laser scanned in order to evaluate one type of three-dimensional documentation technique (Menander et al 2010). The results showed that there were great potential and good opportunities to use the laser scanner as a tool. An important lesson from this first attempt was, however, that a three-dimensional approach meant a whole new way of thinking, both in practice and in theory. The work could then, as now, be characterized by new issues, perspectives and possibilities, but also insights into the problems and limitations of the method, as the work proceeds. It was also clear that the development must be gradual so that we first sought to examine, develop and evaluate three-dimensional documentation methods, and that a second step must be to work on the interpretation process and on the visualization of the building.

In 2010, the project sought funding from the Swedish National Heritage Board’s R & D funds. The project “New methods for building archaeological documentation and analysis process, preliminary study” (Dnr 353-3192-2010) was awarded funding for 2011 intended to further develop the process of using three-dimensional documentation methods. As an important objective was also to continue cooperation and knowledge-building at an international level, the Lateran baptistery in Rome was re-elected as objects and experimental workshop. The campaign in 2011 has involved just over two weeks of field-work in September, were we have laser- and photo scan-
ned the entire Lateran baptistery. The results and an evaluation of our work are presented in this report.

**Implementation of the project**

The plan for the 2011 campaign was to laser scan the exterior of the baptistery since we learned during the 2010 campaign that laser scanning was a good method to catch the shape of the walls. The plan also included a test with computer vision techniques. All the scans we made in 2010 were done with the scanner standing on an ordinary tripod on the ground. Since the baptistery walls are over 15 m high we didn’t get a perfect result relying only on ground level scans. The plan for 2011 was to scan the lower part of the walls with the scanner mounted on a tripod and then make a couple of scans at each facade with the scanner mounted on a tripod attached to the platform of a sky lift.

**Laser scanner**

The laser scanner that we were going to use was a Faro Photon 80 that was kindly borrowed from the Vatican museum. The Photon 80 is a phase shift scanner with relatively short range (about 80 m) but with very high resolution. The scanner is a class 3R scanner that is considered safe if handled
carefully. If a very high resolution (higher laser energy) is used there is a low risk of eye injury very close to the scanner which makes the scanner not so suitable for public environments. In the campaign 2010 the scanner was mostly used indoors but this time the scanner was intended to be used in the crowded piazza outside the baptistery. After having problems to get colorized scans with the laser scanner we decided to try a new method, applying photo scanning, considering other positive experiences in this sense, in Italy and also in the rest of Europe.

**Photo scanning**

“Structure from motion” is a computer vision technique that can reconstruct a 3D-model out of a set of overlapping photographs. Combined with photogrammetric operations the method can be used to, more or less automatically, build detailed three-dimensional models. In this project we have used software called PhotoScan from the Russian company Agisoft LLC. PhotoScan is based on structure from motion and the latest multi-view 3D reconstruction technology where booth image alignment and 3D model reconstruction are fully automated (AgiSoft LLC. 2011).

“Structure from motion” uses the same technique as the human brain when it generates depth information. The fact that objects in the background of an image move more slowly than those in the foreground can be used by computer software to generate depth information. The depth information can be used to analyze correspondences across a set of images and to calculate objects position in 3D-space. This information together with camera parameters can be used to compute a very accurate 3D-model (Ducke et al 2010). This type of image based modeling is both very accurate and detailed. Test has been done that shows that image based techniques has an accuracy that is comparable to laser scanners (El Hakim et al 2008).

Our first results came from photos taken from ground level and we continued to photograph the parts of the building that we could reach from the ground. Before we shot the photos we attached markers to the wall. The markers were later surveyed with total station to get reference coordinates to be able to put different parts of the building together into a bigger model. It was very convenient to use a sky lift for photographing the upper part of the walls but even if the sky lift was very good and had a long range booth horizontally and vertically it was hard to take the photographs in a right angle against the wall. At some of the facades we couldn’t use the sky lift at all and had to take all photos from ground.

The camera that was used for the photo scanning images was a Nikon D80 with an 18-70 mm zoom lens (AF-S Nikkor 18-70 mm 1:3.5 – 4.5G ED). No fixed focal length was used, instead the focal length was adapted (zooming) to the distance from the wall. This wasn’t a problem since the software reads the exif-information from image file and adjusts the lens distortion according to that. A 10.5 mm fisheye lens (AF Fisheye Nikkor 10.5 mm 1:2.8 G ED) was also used on those parts of the building where the vegetation was very close to the wall. The images that were shot with the
fisheye lens had to be calibrated before being processed together with the other images. The calibration parameters were calculated in Agisoft Lens and attached to the pictures in Photoscan for each model they were used.

We tried very hard to take photos when the facades were in shadow but some parts were problematic to photograph without sun due to traffic, parked cars etc. Side B was hardest to photograph without sunlight. The wall was in some parts covered by the sun throughout our working hours. In the end it was a good test for the software to align the images with the sun covered wall.

**Total station survey**

We decided to make separate models of each wall of the building to be able to create models with different resolution. It’s not possible to create a complete model with both high resolution mesh and texture of a building.
like the Baptistery, at least not with the computers we had at hand. To be able to put the different models together they must first be geo-referenced. Our solution to the geo-referencing problem was to survey markers on the facades that also were visible in the photos. This also meant that we had to move the coordinate system around the building. As reference points on the building we used tape markers in the lower parts, but in the upper parts we had to use obvious parts of the walls since it was hard to reach the wall by the sky lift. As reference points to move our local coordinate system we used obvious marks on the buildings in the Lateran area and the buildings around the piazza outside San Giovanni in Laterano. For the surveying we used a Leica TPS 09.

**Modeling – Processing the images**

The images that were taken were sorted into folders, one folder for each wall. One model was produced for each wall with overlapping to the facades on each side. Approximately 200-400 pictures were processed in Agisoft Photoscan professional (ver. 0.8.3) for each facade.

The first step in the process is called Image align. At this step common points in the pictures are recognized and matched. At this point also the camera positions are calculated and the images are calibrated according to the camera settings. The result is a sparse point cloud and the camera positions. It was hard to process the pictures from side B. Since the ground...
level pictures were taken when the wall was in shadow it was hard to align them with the sky lift pictures that was taken in partial sun.

The second step in the processing is called Build geometry. In this step the mesh is built based on the calculated camera positions and the photos. Different methods can be applied to the Build mesh command.

The third processing step is called Build texture. In this step the mesh is given detail and color from the original images.

After the modeling of the facades the georeferencing took place. When georeferencing a model a coordinate system is attached so that the dif-
Different walls can be combined in an other software. When georeferencing the markers on the walls was used. Since the markers were surveyed with the total station we knew their coordinates. The markers were pointed out in the texturized Photoscan model and were matched with the surveyed coordinates. During the georeferencing a quality control is done presenting the error in the process. During the georeferencing of the walls the mean error was about 2-3 cm.

Modeling – Working with models

Further post-processing of the models has been done in Meshlab (ver 1.30). In Meshlab a lot of filters can be applied to the models. It is easy to edit, simplify and combine different models. It is also possible to see the models under different light conditions since it is possible to change the light and get artificial shadows.
Evaluation

The aim of the project was to provide a preliminary study for a broader application regarding building archaeological theory and methods. Furthermore, the project was expected to result in new working routines and in particular knowledge of how to document and analyze a building in three dimensions. An important achievement was also to continue the unique exchange of knowledge that exists between Swedish and Italian building archaeologists that Olof Brandt started already in 2005, a fruitful cooperation which has deepened due to the research project “The Lateran Baptistery in three dimensions” (see above). On a general and comprehensive level, it is beyond all doubt that building archaeology is in need of research projects to be developed. It is also clear that the development should be done on a physical object that can be used as a testing ground where the results are measurable. In order to develop methods and the process of thinking, it has been essential to discuss and meet researchers and practitioners in other related disciplines which predominantly occurred in conjunction with seminars and workshops where the project has been presented (see below).

On several occasions during the work, we found that the Lateran baptistery in many ways is a difficult object. It requires, for example, permission to work with the building, the baptistery is also one of Rome’s tourist attractions and in the same area is the Pontificia Università Laternense which means that hundreds of people pass the building every day. The baptistery is also a very large building with a long and complicated building history. The building material, small and thin Roman bricks, requires that the pictures have a higher accuracy and better resolution than if, for example, the masonry consists of large unworked blocks. Despite this, or perhaps because of all these difficulties, the project–group agrees that the Lateran baptistery provides the perfect platform and starting point for a research project of our kind. In the project a major stumbling block has been to try to push the boundaries, try new ways, “dare” to do wrong, try again and evaluate. This can naturally have an impact on the results but it has been more important for the project to find new viable documentation methods and really push and evaluate them than to obtain a complete and perfect three-dimensional model of the baptistery. Due to the fact that it was a major challenge to find ways to do a three dimensional documentation of the whole building, there was no time or opportunity in the frame work of this project to explore how the results can be used for more sophisticated analysis. How to use the results and explore the 3D way of thinking when analyzing the material is therefore the next step in our project. Below follows an evaluation of for- respectively disadvantages of using the photo-scanning method.

Technical pros and cons

The Photo scan technique is very convenient and easily used. Compared with laser scanning there are a lot of advantages but also a couple of drawbacks. The Photo scan equipment (the camera) is much easier to handle, for
instance from a sky lift and it is easy to get a lot of “scan positions” to cover all parts of a wall. It had been much harder with a laser scanner since every scan takes much longer time. In comparison it is much easier to get a higher resolution with a laser scanner, to obtain the same resolution with photo scanning there is a need for a lot of photographs taken very close to object. Usually the laser scanner gives a much higher resolution than is needed so that is not a problem, at least not in this case since the photo scan method gives the needed resolution. Since we knew that the photo scan method could have problems with feature extraction from images with repetitive patterns or a lack of structure (Morel and Yu 2009), we were afraid that the walls with small roman bricks would give us problems. Agisoft Photoscan hadn’t any problems with the parts of the walls where the bricks were undamaged but in some parts where the bricks had been trimmed, probably to make the wall more even before applying plaster, the software had trouble to find the structure. Problems like this can probably be solved by taking more photos at a shorter distance.

The most complicated part of photo scanning is to take the photographs. When modeling a facade the result will be better if the photographs are evenly distributed over wall and taken at a right angle towards the wall. The light conditions are also more important when photo scanning compared to laser scanning. All photos of an object should be taken at the same time to get a good result. If the light conditions change to much between two sets of photos there is a risk that the software can’t combine the different photos. The result from a laser scanner doesn’t have these problems.

The Photoscan method is very cheap compared to the laser scan method. The photo scan method demands a relatively expensive computer to be able to post process the photos but that is still very cheap compared to the cost of a laser scanner. The post processing of photo scan pictures takes also time depending on how many pictures used but this is computing time when the computer works on its own. It’s also possible to batch process pictures so that the computer can process a lot of photos on its own during nights or even during weekends.

Of course we did some mistakes since the used method was the plan-b for the project. One mistake was the names of the images. Since we totally emptied the memory card to camera after every photo session the camera restarted the name giving and gave the same name to the pictures in several photo sessions. We should have renamed the pictures and given them unique names already in the camera or in separate software after copying them to the computer which had made the post processing easier.

**Comparing Laser Scanner and Photo scanning**

Both these technologies have different fields of applications, from small objects to building or archaeological sites. We have to recognize some advantages for photo scanning, as the possibility to work with a low-cost equipment, just a camera and a computer; it offers also the possibility to do a fast, not so planned documentation and it’s also possible to work with old
pictures. But, at the same time, this technology have limits and the main problem is that the operator can control the results only during the post-processing phase of work. Instead, even if laser scanner is obviously more expensive, sometimes heavy to transport and move, it permits to check the result directly on the field work.

For our work we considered all these factors and decided to combine these two techniques, trying to find the best way to document the building and adapting our choice to the different situations. For this reason we preferred to use the laser scanner one the inside the baptistery (Menander et al 2010) and the photo scan method outside, around the eight facades.

**Dissemination**

The result of the project’s work on laser- and photo scanning the Lateran baptistery has and will be disseminated in several different ways and to various people in the fields of culture heritage management. The work has been compiled in written form in this report which is published in the National Heritage Board UV’s series of reports, both on paper and as a PDF-file which can be downloaded on the National Heritage Board, UV’s website,
View of facade B.
View of facade C.
View of facade D.
View of facade E.
View of facade F.
View of facade G.
View of facade H.
http://www.arkeologiuv.se/cms/arkeologiuv/publikationer/rapporter.html. A link to the report will also be available at the Swedish Institute in Rome and at PIAC’s websites. The report will be distributed in paper form or as a PDF-file to other building archaeologists and to appropriate persons in the field of cultural management.

The project has been presented in different kinds of seminars. Before the actual field-work Hanna Menander and Håkan Thorén held a lecture called “Documentation of Swedish and Italian sites using laser-based techniques” at the seminar “Laser for Cultural Heritage. Italy - Swedish Bilateral Workshop” at the Italian Cultural Institute in Stockholm in December 2010. Hanna Menander has presented the work at the National Heritage Board, UV Öst’s archaeologist seminar. Håkan Thorén has presented the project at the CAA-SE conference in Uppsala in November 2011. Olof Brandt was at the seminar “Alle origini di Albenga cristiana: nuove prospettive di Ricerche e Studi” held in Albenga in Italy in the summer of 2011 and presented the project with the lecture, “L’ESPERIENZA del Seminario di Studio Internazionale sul Battistero lateranense”. In conjunction with the field-work the project organized a seminar at the Swedish Institute in Rome with the title “New documentation and analysis processes: evaluation of the ongoing work at Lateran baptistery”. During the seminar, there was also a meeting with the reference group for further consideration and evaluation of the current project.

The project will also be presented in an article in a forthcoming publication about the results from Swedish National Heritage Board’s R & D funds. In January 2012 the project will participate in the Culture heritage management seminar in Rome called “Kulturarv, tradition, förmedling. Romerska fallstudier in situ”.

The project application states that the project during the course of the work would have a blog on the UV’s website. Due to time constraints and demanding work efforts, including long working hours, this was not possible to implement. The project and the various work phases will instead be presented in pictures and in text on the UV’s special website for building archeology that is under construction.

**The next step in the project**

This project was as a pre-study, which aimed to provide a basis for a larger and more extensive application. The project works on a type of three-step model in which the first step has been to find new methods for three-dimensional documentation. The next step in the building archaeological work process is to develop the three-dimensional analysis and interpretation, i.e., how processed, interpreted and analyzed in a three-dimensional forms of documentation. This work forms the basis for the next step, reconstruction and interpretation. How can the building be reconstructed and depicted three-dimensionally? How can we make the results available and communicate the building’s history to the various target groups and audiences? The first stage in the process of finding new methods for building archaeological
documentation and analysis is completed within this year's field-work and this report. The results of the pre-study has shown that there are different techniques to achieve a three-dimensional documentation and that it is both the object but also the aim that must decide the choice of technology. The pre-study has also shown that the so-called photo scanning method can be used on a large and complex building like Lateran baptistery in Rome.

In order to implement the next step of the project a new application has been submitted to the National Heritage Board’s R & D-funds. The intention is to complete the next step with an extended project-group in which even proponents from other disciplines are included in the project as well as in the reference group. The next part of the project is divided into two parts where the first part consists of a short field campaign. The second part includes two workshops, one in connection with the field-work in Rome and one at the seminar "Digital Humanities" in Lund, where the project will be presented. The purpose of the workshop working method is to work interdisciplinary with different peoples in the field of cultural heritage management; archaeologists, system developers, building antiquarians etc, to be able to discuss new questions, analytical possibilities but also problem areas. This work will then form the basis for the third phase, communicating the results, i.e., reconstruct and visualize the baptistery.
References


Krautheimer, R. 1993. Architettura sacra paleocristiana e medievale e altri saggi su Rinascimento e Barocco. Torino


Administrative data

Country: Vatican State
Location: Extraterritorial area of San Giovanni in Laterano, the Lateran Baptistery.

Coordinate: Local
Height System: Local

Riksantikvariämbetet, Verkssekretariatet, FoU-medel, (FoU-funds) dnr: 353-3192-2010
Riksantikvarieämbetet, Arkeologiska uppdragssverksamheten, UV (Swedish National Heritage Board, UV) dnr: 750-431-04033-2011
Project number: 11866
Intrasisprojekt: -
Report Number: 2012:1

Project leader: Hanna Menander (RAÄ, UV)
Responsible scientific Direction: Olof Brandt (Dr. PIAC)
Project Coordinator: Agostina Appetechia (Dr. PIAC)
Technology Manager: Håkan Thorén, (RAÄ, UV)
Administrative Coordinator: Swedish Institute in Rome

Responsible antiquarian authority: Vatican museums, Maria Mari, Paola Benetto
Reference persons: Federico Guidobaldi, Prof., PIAC
Barbro Santillo Frizell, Prof., Director of Swedish Institute in Rome
Anders Kaliff, Prof., University of Uppsala, RAÄ

Investigation time: 5-21 September 2011

Archive Documents: -