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Architectural and urban archaeology. An example of building analysis applied to an urban centre: the case of Pisa

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Although much desired over the past years, architectural archaeology methods have rarely been applied to an entire urban context, especially given the long research time needed. The study of the buildings of Pisa is part of the MAPPA project and its aim is to provide the project with further data which may be used for defining archaeological potential. The study also seeks to propose a new experimental language for the application of a stratigraphic method to a very large area, such as an entire city. The methodological choices made are described in the study, together with the problems addressed during the research activities. Details are also provided on the work phases and the first conclusions on the current status of the works are given.

Keywords: building archaeology, city, periodisation, database, GIS

1. The endless number of possibilities

Italian and European history recognises the central role played by cities, regarded as a breeding ground for ideas and experimentation pertaining to institutional, religious, political and settlement aspects. These aspects influence the surrounding areas in a more or less significant and long-lasting manner, assuming a reciprocal relationship with the countryside and other urban environments (BENEVOLO 1993: 3). An aspect affected by this variety is architecture, regarded as the mirror of taste, economy and technological levels attained by society: it shows us how man relates to the surrounding environment and how groups of people interact either by choosing to imitate others, adopting similar models or introducing different patterns since they refuse the ones proposed. Architecture may be studied in many ways, depending on the purposes to be achieved or the methods involved. In this context, the tools provided by architectural archaeology were used to diachronically inspect the urban tissue of Pisa (from earliest evidence through to current times) included in the late-medieval walls. Military, civil and religious

buildings were considered, regardless of their chronology, function and materials used. This study is part of the MAPPA project developed by Università di Pisa and its aim is to provide the project with further data that may be used for defining archaeological potential . The study also seeks to test the application of the stratigraphic method to a very large area, such as an entire city, with well-defined research times. The need to analyse an artefact, its transformation and the meaning it assumes in the eyes of both contemporary societies and posterity is clear to archaeologists. This consideration cannot disregard architecture, for which the field of reference in the case of cities is usually restricted to a neighbourhood, chapel, more or less large construction or – when analysing the entire urban tissue – to elements of a specific chronology or type. The manner in which the different components interact and are mutually influenced in their choice of styles and techniques, becomes more significant the wider the context within

Figure 1. Pisa. The area of study situated inside the late-medieval walls.

which specific models are compared and developed. Although much desired over the past years, architectural archaeology methods have rarely been applied to an entire urban context (Brogiolo, Cagnana 2012: 22-23; Causarano, Valenti 2011), probably due to the long research time needed. The opportunity provided by the MAPPA project to merge data collected by various professionals – who studied Pisa from different viewpoints (Anichini *et alii* 2012a) and with widespread approaches – allowed us to test and understand the existing problems, attainable results and most effective recording methods to be used. The next step will be to study the collected data, together with the social and economic reconstructions inherent to architectural archaeology, which will offer a more in-depth focus than the analysis of buildings, which in turn is mainly directed towards collecting data regarding sequences, materials and functions (Brogiolo 1997). One cannot exist without the other, because historical interpretation needs numerous, objective and well-documented data. We tried not to give too much attention to detail or record interventions too generally while studying such a widespread context as Pisa. Further study will allow us to examine more closely aspects that have been dealt with marginally (for example, openings and their relationship with construction techniques) as well as identify the clients and professionals involved in the various categories of artefacts and understand how the mutual relationships between clients and architecture have varied throughout the centuries.

2. Methodological choices

The main aspects that necessarily had to be taken into account when planning the activities were the short time available and the large amount of samples to be analysed: the late-medieval walls originally covered a distance of around 7 km, corresponding to a surface slightly larger than 2 square kilometres. The creation of smooth recording procedures allowing the registration of all significant information, therefore, was needed. The aim was to facilitate georeferencing of the data collected as well as their use by the public (whether professionals or simple enthusiasts) and their immediate utilisation in order to reconstruct the development of Pisa throughout the centuries and understand how and when the surface area developed over the ages.

2.1 Definition of the research scope

Architectural archaeology may be regarded as a non-destructive vertical excavation which, although allowing analyses to be repeated easily, does not allow all the complex aspects included in a building artefact to be identified, consequently restricting the analysis only to the facing.

Just as archaeological analyses have physical, artificial or natural limits, a new container similar to an excavation limit was created for recording the architectural evidences of each period: the Urban Architectural Unit (UAU, abbreviated with the letter 'U' in the alpha-numeric ID attributed to each Unit), which provides a photograph of the current situation. UAUs are necessary because more wide-ranging Reference Units – i.e. Architectural Buildings (CAs) – often merge into one structure (Brogiolo, Cagnana 2012: 27). An example is the Municipality of Pisa, whose offices are located both inside Palazzo Mosca and the adjacent Palazzo Gambacorti: both must be considered CAs because they are composed of different buildings and intermediate structures. The same can be said of Pisa University, the owner of many adjacent, multi-layered and multi-combined buildings. To compensate for the lack of the higher-level taxon and, therefore, to avoid the repetition of names and ensure an exhaustive collection of data, the above definition was created.

Adjacent buildings belonging to the same owner or featuring the same plasterwork or similar openings are considered as belonging to one UAU and are analysed together within their stratigraphic history. Although we attempted to objectively define the limits to be examined, it was not always possible to establish the limit of an UAU, especially with regard to its internal development which could not be inspected from the road or from above. For this reason, we opted for arbitrary boundaries for the parts not subject to any kind of analysis, in view of further information which will allow this issue to be gradually solved.

Once the larger "container" was defined, it was divided into individual building Phases which were examined in order to identify the main Construction events (or CF regarded as the minimum unit of reference), the creation of Architectural Buildings (CAs) and the most significant transformations involving both (conversions into one building, raising, levelling and plastering with significant addition of openings). The large size of the sample analysed made it necessary to adjust the analysis scale; for this reason, many interventions were merged into one single Phase. The Architectural Unit often coincided with a CF or a CA.

If the presence of a building inside a CA and a UAU is evidenced only by a small fragment, with regard to which, however, it is not possible to establish the type of construction, function or chronology of the structure of belonging, reference to it is only made in the Phase record, but no CF record is associated to it, which, however, could be created once more significant information becomes available.

The term 'CA' usually indicates a group of structures; in many cases, however, these elements cannot be identified due to the exterior surfaces. We decided, therefore, to assign this term to those cases which, although practically impossible to read, had more than one house number, revealing how the building may be regarded, at least conceptually, as an assemblage made up of separate parts.

The analysis of the urban tissue focused on the buildings' exteriors, since directly available, whereas the

interiors were described only in certain situations, such as in the case of public buildings to which access was easy. The study of building interiors would also need much longer time than that available also due to the fact that house owners are not always willing to authorise access to the interior of their houses. The cases considered as being the most significant will be dealt with in detail during continuation of the activities.

2.2 Research tools

Recognition of these construction Phases not only led to identifying a CF or CA, but also to entering the interventions in a chronological grid, based on the data of published urban excavations, on the prior analysis of buildings, on published written sources and, finally, on the physical relationships between the supporting, roofing and levelling components. Two main tools were used to identify the material traces. The first most commonly used tool is to directly observe the buildings and record their current situation. Every city, however, is also an ongoing construction site. For this reason, a large amount of scaffolding which covered the fronts of the buildings and prevented them from being examined needed to be taken into account and, although of a temporary nature, hindered our study nonetheless. To solve this issue, two different observation tools were used, when possible: Google Earth and Google Map. The street view functions, which provide images from recent years, allowed us, on the one hand, to document the building before the construction site and, on the other, to confirm the presence of masonry fragments currently hidden by the plastering due to restoration subsequent to the recordings. At the same time, the Internet is an archive of information similar to a photographic archive since it fixes moments of construction of which there is now no longer trace (for example, openings that have not only been filled in but completely cancelled from the exterior surface).

2.3 Chronological range

The analysis system adopted envisages the increase or modification of the data acquired up to now, since the legibility of the front of a building can change and depends on the plaster which, if removed, can integrate currently partial information or correct certain reconstruction hypotheses. Regarding attribution of a chronological range for the Phases and the buildings identified, the gap between the initial and final date is greater, the lower the amount of data available. Given the lack of accurate reference elements, we decided to use a wide chronological range covering the periods adopted by the entire workgroup (late middle ages XI-XIII; late middle ages XIV-XV...), confident that this range may be reduced with time after a more detailed examination of both excavations and buildings and especially (as stated above) if the legibility of the latter were to improve.
Regarding most recent Phases, the sentence «the structure receives its current aspect...» was often used to indicate that it was not possible to receive any information prior to that mentioned. This does not mean that information does not exist, but that it may simply have been cancelled by most recent interventions. For this reason, a house that today features a XIX century facies could tomorrow reveal a more complex stratification and ancient origin, following an excavation, archive research, survey of its interiors or greater knowledge of the architecture of Pisa.

2.4 Problems

The transparency with which data must be provided needs to be accompanied by photographs (see infra, paragraph 3) which allow those working in the sector to find the more specific elements described in the records and the public in general to locate in space the traces that have stratified on the façades of a UAU/CA/CF over time. We attempted to do this (although not always possible) for each situation regardless of the chronology and function of the object being studied. The data collected on the city also allowed us to further understand how Pisa has grown over the centuries, based on the calculation of the below ground level of the buildings, given by the difference between the current ground surface and the ground surface of every CF at the time of construction. This information is only rarely fully accurate. Indeed, despite the numerous urban excavations (MAPPAGIS), not many regard buildings that still stand so it is not easy to establish the height of the floors in the past. Furthermore, with regard to the Middle Ages, we do not know if all the tower houses were built with standard measurements and similar distances between the floors; indeed they may have greatly varied compared to today. Despite these evident difficulties, we performed excavations and cuts and also observed the buildings so as to identify the maximum and minimum reference measures within which to locate the obtained measurement.
A final clarification that needs to be made regards the possible different approach taken when studying the UAUs and their components, due to the fact that the work is the result of just two people; consequently, although the criteria of reference and the fields to be analysed are the same, subjectivity (the consequence of different educational experiences) can never be completely eliminated and should be considered as an opportunity for dialogue and mutual enrichment.

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3. Work Phases

The initial work phase consisted in expanding the project relational database (RDBMS) by creating tables which record and analyse the data collected on the city buildings and make their content usable through the use of a shared and standardised the-

saurus. Creation of this part of the RDBMS aimed at describing the historical, city and architectural details of the Pisa urban area starting from the detailed analysis of macro-structures which describe the current city, called UAUs (Urban Architectural Units).

One of the first difficulties encountered during this phase of the project was the need to synthesise and uniform the volume and variety of the data gradually acquired when analysing the city's buildings. For this reason, a container needed to be developed that could allow us to gather the greatest possible amount of information with characteristics varying in terms of type and chronology. It was also necessary to have an open structure that could be easily integrated both in terms of data implementation and modification of the structure itself.

3.1 Creation of the database for the recording and analysis of data regarding the city's Buildings

The data were grouped inside the database by using Microsoft Access software and were divided into three logical levels which gradually handle the information through a descriptive synthesis process. This process, starting from the macroscopic definition of the UAU (Urban Architectural Unit), allows the detailed analysis of accurate typological categories called CF (Construction) and CA (Architectural Building) within chronological intervention divisions called PHASES.

The scheme that synthetically describes the levels and relations between the various objects under study starts from the UAU Record which describes the actual situation of the city. The second level of the structure combines the data related to the various intervention PHASES identified in the UAU: each record describes the materials, manufacturing and laying specifically linked to that constructive segment and its related chronology; furthermore, the CF or CA included in the phase examined are synthetically described. In the Third level of the structure, the CA or CF comprising the UAU are analytically described. The uniformisation of the analysed building, therefore, takes place through a procedure based on three descriptive levels which analyse the current situation of the city through different queries – spatial, chronological and typological. To conclude, when creating the RDBMS, the aim was to allow the minimum and maximum level of information about the data collected on the city's buildings to maintain a dialogue within one structure, via a dynamic, comparative-analysis process.

Similarly to the recording of archaeological intervention data, even the RDBMS architecture on buildings is based on a series of tables linked to each other . The tables contain the archived data and the thesauri or lists of values necessary for filling certain fields in guided mode (Anichini *et alii* 2012b).

3.1.1 Urban Architectural Unit (UAU) record

Based on the idea that the UAU should be considered as the minimum common denominator (i.e. the unit of reference of the current city for the topographic management of building data), a record[1] was created that highlighted both its basic traits and information and also identified the main characteristics, type, function and chronological setting according to its current aspect. The guiding principle of the UAU record was to provide the system user with an information item allowing identification and immediate recognition of the area of study and at the same time cross-reference to specific data (PHASES).

Fields:

UAU ID: "alpha-numeric" field reporting the univocal ID code of the Urban Architectural Unit, or of the unit of reference upon which the analysis of the current city is based;

Name: "text" field which identifies the address of the Unit considered or reports the name with which the Unit is currently known (for example, *Church..../Hospital....*);

Function: ComoBox "text" field linked to the *Thesaurus_current_function* table which lists 14 items defining the Unit's current function. In the event that an UAU has more than one function, only the prevailing function can be chosen:

- Public
- Commercial
- Educational
- Abandoned
- Warehouse/garage
- Military
- Mixed
- Religious
- Residential
- Accommodation
- Leisure-cultural
- Health
- Sport
- Transport

Initial chronology: ComoBox "text" field linked to the *Chronology thesaurus table*[2];

Final chronology: ComoBox "text" field linked to the *Chronology thesaurus table*[3];

Initial date: free "number" field;

Final date: free "number" field.

A chronological setting was used for the chronological definition of the buildings. A very wide diachronic range was chosen (from pre-history to contemporary

1 All the records were set as tables with an equivalent form

2 For the items contained in the table see Anichini *et alii* 2012b: 14-15

3 For the items contained in the table see Anichini *et alii* 2012b: 14-15

age, including the present day), by combining a text field together with an absolute and validated number field, in order to identify as precisely as possible an initial and final date for the UAU taken into consideration. The initial chronology in this record is strictly connected to the current FUNCTION of the Unit and not to the construction of the building (or buildings) comprising the UAU, subsequently identified as CF (Construction) or CA (Architectural Building) with a univocal initial and final chronology.

Type of construction: ComboBox "text" field linked to the *construction type thesaurus table* which lists 16 items defining the current aspect of the Urban Architectural Unit and identifying their type of construction:

- bulwark
- baptistery
- bell tower
- tower house with continuous horizontal masonry
- tower house with continuous vertical masonry
- tower house with free pillars on the façade
- tower house with partially free pillars on the façade
- tower house with free pillars
- non-definable tower house
- church
- convent
- walls
- large building/block of flats
- door
- prefabricated building
- masonry structure interrupted by openings
- villa

Dating elements: "text" field containing the elements that guide the dating of the UAU towards a precise historical age;

First evidence: "number" field containing the first documentary evidence of the UAU taken into consideration;

Documentary evidence: "text" field in which documentary and bibliographical references to the UAU are listed.

Links can be opened from the UAU Record form which sends users to the Phase Record for Buildings form, CA Record form, CF Record form and Bibliography; lastly, there is a number field that identifies the number of photos referring to the UAU.

3.1.2 Phase record for buildings

The phase record for buildings details the basic traits and information of every significant intervention on the UAU and indicates any CF and CA involved.

Fields:

Phase ID: "alpha-numeric" field reporting the univocal

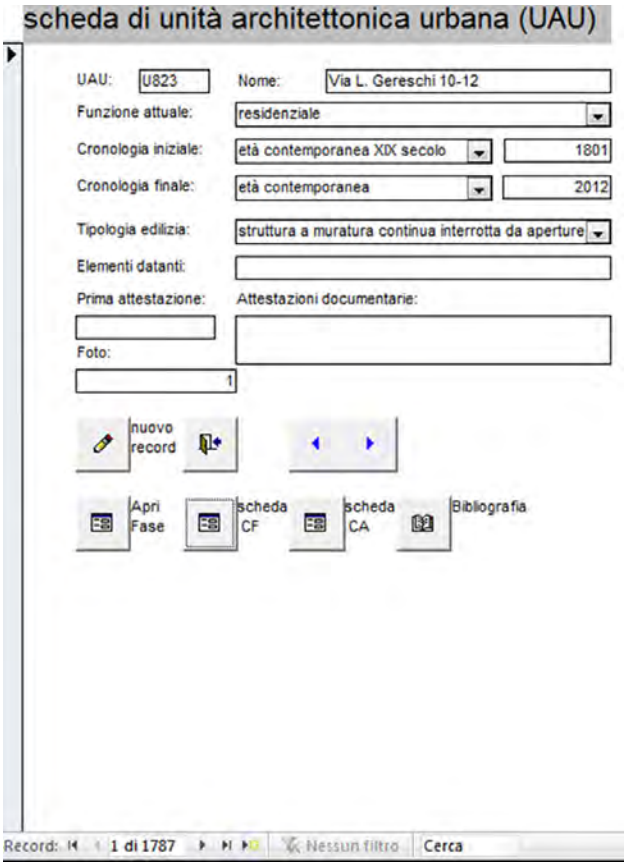


Figure 2. Example of UAU Record.

ID code of the phase directly connected to the Urban Architectural Unit;

CF ID/ CA ID: "alpha-numeric" fields reporting the univocal ID codes of the CA and CF involved in the phase;

Materials: "text" field which describes the materials involved in the phase;

Laying: "text" field which describes the procedure used for laying the listed materials;

Manufacturing: "text" field which describes the manufacturing of the materials.

These data (**materials, laying, manufacturing**) are still being studied so are not available in the first version of the webGIS which is a product constantly under implementation.

Initial Chronology: ComboBox "text" field linked to the *Chronology thesaurus table*[4];

Final Chronology: ComboBox "text" field linked to the *Chronology thesaurus table*[5];

Initial date: free "number" field;

Final date: free "number" field.

The initial and final chronology identified in this record is exclusively linked to the PHASE examined by the above Record.

4 For the items contained in the table see Anichini *et alii* 2012b: 14-15

5 For the items contained in the table see Anichini *et alii* 2012b: 14-15

Figure 3. Example of Architectural Phase Record.

Dating elements: "text" field containing the elements that guide the dating of the PHASE towards a precise historical age;

Documentary evidence: "text" field in which documentary and bibliographical references to the PHASE are listed;

Description: free "text" field containing the description of the phase taken into consideration as well as the transformations which the CF/CA belonging to the UAU have undergone;

Current height: "number" field;

Original height: "number" field;

Below ground level: "number" field

On the basis of: ComboBox "text" field, linked to the below ground *level_thesaurus table* which identifies seven points of reference for measuring the below ground level of the building

- Supporting holes
- Windows
- Fornices
- Stringcourses
- Corbels
- Floors
- Portals

Only a few buildings were identified during this first work phase; heights were calculated on the basis of accurate points of reference related to clearly identifiable historical periods (significant heights referring to the medieval, modern and contemporary ages).

Further five "text" fields are included in this record: *Fornices, Portals, Windows, Putlog Holes, Supporting Corbels*. These five fields will be included in a second, more detailed work phase which will examine these aspects in greater detail and analyse the relationship between these structures and the different techniques and construction phases.

3.1.3 Construction record/ Architectural Building record

The CF Record and CA Record should be situated at the same level of the Database architecture; they feature the same structure.

Fields:

UAU ID: "alpha-numeric" field reporting the univocal ID code of the Urban Architectural Unit taken into consideration;

CF ID/CA ID: "alpha-numeric" field defining the univocal ID code of the CF/CA;

Name: "text" field which reports the ID identifying the CF (address, house number);

Type of construction: ComboBox "text" field linked to the *type of construction thesaurus table* which lists 16 items defining the type of CF[6];

Function: ComboBox "text" field linked to the Current_function_thesaurus table which lists 14 items defining the function of the CF during its existence[7];

Initial chronology: ComboBox "text" field linked to the *chronology thesaurus table*[8];

Final chronology: ComboBox "text" field linked to the *chronology thesaurus table*[9];

Initial date: free "number" field;

Final date: free "number" field.

The initial and final chronology identified in this record is strictly linked to the "creation" of the CF.

Description: free "text" field in which the history and conformation of the CF or CA taken into consideration are described.

3.1.4 Synthesis record

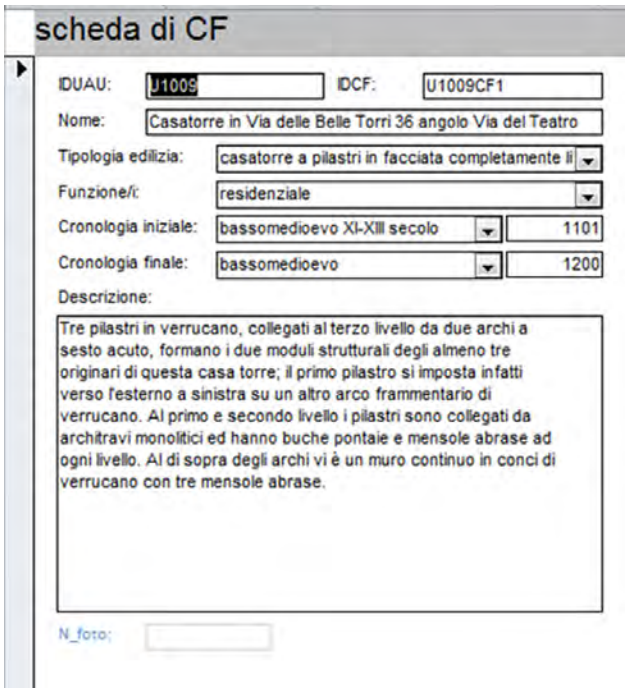
As in the case of the tables linked to the archaeological interventions data, the building analysis data also merge into the *Synthesis record – Level III Synthesis* (Anichini *et alii* 2012b: 16; Fabiani, Gattiglia 2012: 63 ss and Appendix I.) whose purpose is to create a common environment in order to compare and synthesise data of different origin and use for analysing the city's buildings. The record combines Level III, II and I definitions. The fields (Level I, II and III) are

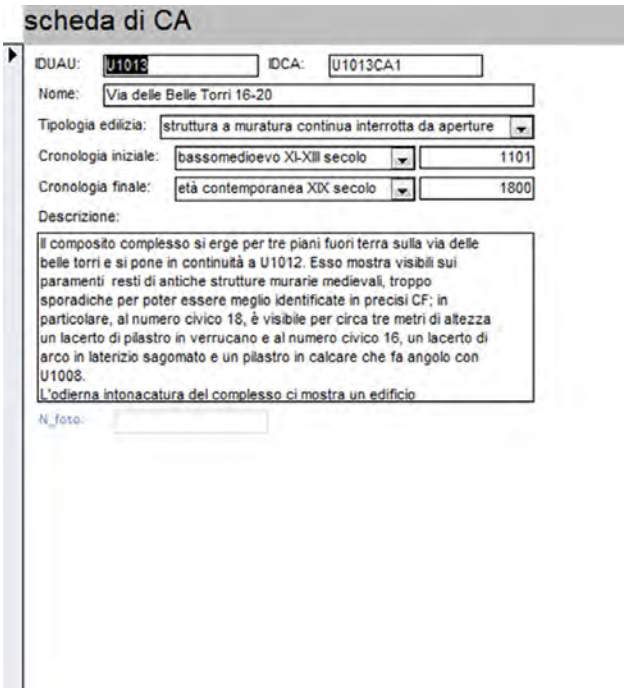
6 See the list of construction types in the UAU Record.

7 See the list of functions in the UAU Record.

8 For the items contained in the table see Anichini *et alii* 2012b: 14-15

9 For the items contained in the table see Anichini *et alii* 2012b: 14-15





Figures 4-5. Examples of CF/CA Records.

ComboBox "text" fields. Each field is linked to its own thesaurus table which depends (with the exception of Level I) on the term entered in the previous level. A chronological range (***Initial Date*** and ***Final Date***) is also included in this record, which all CFs and CAs analysed in the previous records refer to. The fields are both in text form – with the possibility to choose the sub-periods ("text" field, linked to the *chronology thesaurus* table) – and in number form (free "number" field). The record also includes a ***Height*** field and related ***Reliability*** field[10]. To fill them in, reference may be made to the instructions provided in 2.1 above. Further two fields, which were not taken into consideration when analysing the buildings, yet necessary in the RDBMS for examining the archaeological data, are ***Period ID*** and ***Intervention ID***. The analysis of the buildings made it necessary to fill in the ***Other ID*** field in which the univocal ID code of each single CA/CF analysed was included. At the end of the first work phase, which lasted less than a year and led to the synthetic analysis of the buildings inside the city walls, a total of 1787 UAU Records 2381 Phase Records, 1188 CA Records and 1061 CF Redorsds were catalogued, totalling 6417 records. These data will implement the already large number of archaeological data available on the city of Pisa.

3.1.5 User interface

To allow the RDBMS data to be used by a higher number of users, an easy-to-use interface was developed for browsing and searching through a series of forms. The user interface allows comprehensive reading of the building data, by ranging from single buildings to larger architectural structures, and proposes a route that identifies the various historical phases of each building. The user interface forms were created by using queries between different tables and including sub-forms.

A search was developed, therefore, starting directly from the analysis of the current CFs/CAs and from the intervention phases involving them. Consequently, external users may perform searches directly on the object (single building or architectural structure) or on a phase, connected to a specific historical age.

The following fields are reported in the CA/CF Record:

- *General data:*
  - -UAU ID
  - -UAU Name
  - -UAU Bibliography
  - -UAU Photo

Regarding the photos, we decided to photograph the fronts of a building or larger structure which were easier to interpret and which showed the presence of visible historical phases. The photographs were taken without ranging poles because they were considered as simple eidotypes with descriptive value; they include orientation of the front of the buildings and, in most significant cases, indications of Phases and CFs/CAs.

- *CF/CA Data*
  - -Name
  - -Initial chronology
  - -Final chronology
  - -First evidence

10 Expressed with a scale values from 3 (highest reliability) to 1 (low reliability).

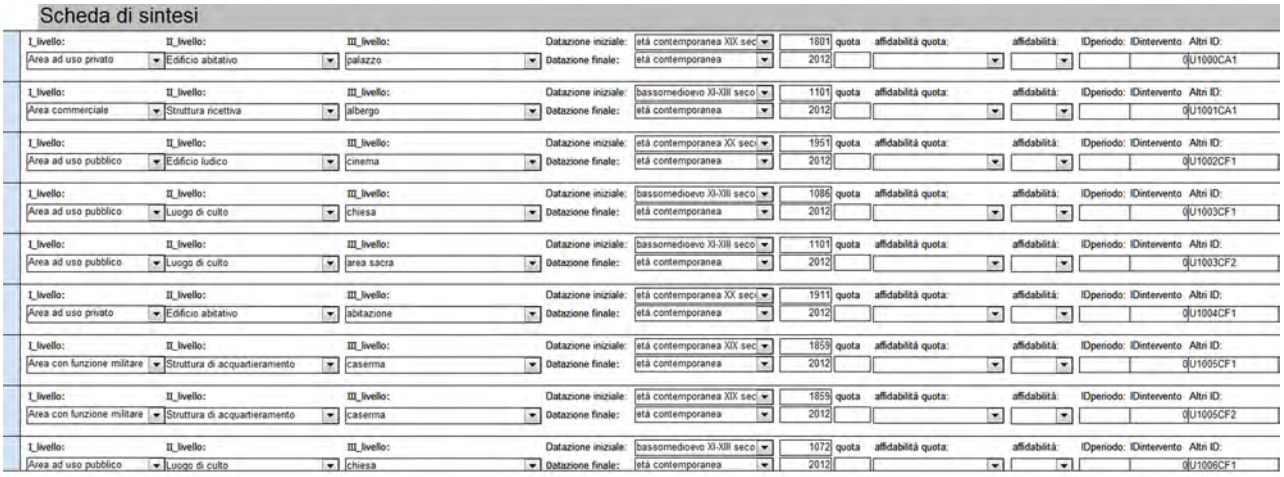


Figure 6. Example of Synthesis Record.

-Type
-Function
-Description

- UAU Phases involving the CF/CA

Example:

- Phase 1,2,3....and related **Chronology**

It is possible to access the corresponding record of each Phase from this part of the record.

The following fields are reported in the *Phase Record*, after repetition of the *General data* related to the UAU of reference:

- *Phase data*
  -Initial chronology
  -Final chronology
  -Description

- *CF/CA Inerested by the phase*

Example:

-CF1/CA1... and related **Chronology**

It is possible to access the corresponding record of each CF/CA from this part of the record.

3.2. DATA Georeferencing

Together with the direct analysis of the city's buildings and the creation and compiling of the RDBMS, a platform for the georeferenced identification of the elements was created on ESRI ArcGIS software (Fabiani, Gattiglia 2012: 52). Transfer of the basic RDBMS elements into a GIS open functional model, with no repetitions, required a series of steps to be taken aimed at rationalising the data archiving process in order to facilitate a thorough reordering of information and allow data about the urban environment to be easily used (Fronza 2009). Specifically, the data on buildings are organised in the MAPPA Geodatabase architecture, inside a feature dataset called Buildings, which contains the UAU, CF, CA and PHASES feature classes. Polygonal and linear geometric primitives were used for the graphical representation of the extensive amount of objects analysed; in particular, every UAU, CA and CF corresponds to a polygonal feature that identifies every single unit of interest, whereas the phases are identified by linear features.

Every feature has its own table of attributes. The table contains the minimum fields of the ICCD MODI record to which the relational database developed with Access software was subsequently linked, through a join. This setup is based on a methodological prerequisite that uses an approach towards the preserved building structures that is quite similar to the approach adopted for excavations. From this viewpoint, conceptually blending the approach used for excavations with that used for the buildings of an urban centre means developing uniform systems for analysing and using the data produced, thus obtaining solutions and interpretations which can be perfectly integrated (Bianchi 2000).

3.2.1 The structure of the table of attributes on the Geodatabase

The table of attributes referring to every feature (polygonal or linear) created on the GIS software for the analysis of buildings usually has a matrix pattern made of columns and lines: every column corresponds to the single values of the attribute, whereas every line represents the values of all the attributes related to a single geographical element. Among these attributes, the ***Reliability*** field is of particular interest. This field is identified by the abbreviation PRC, which determines the accuracy of the drawing of a specific polygon (UAU-CA-CF) or of a line that identifies an intervention phase. This value is determined by a number scale from 1 to 3 (1 is the lowest level

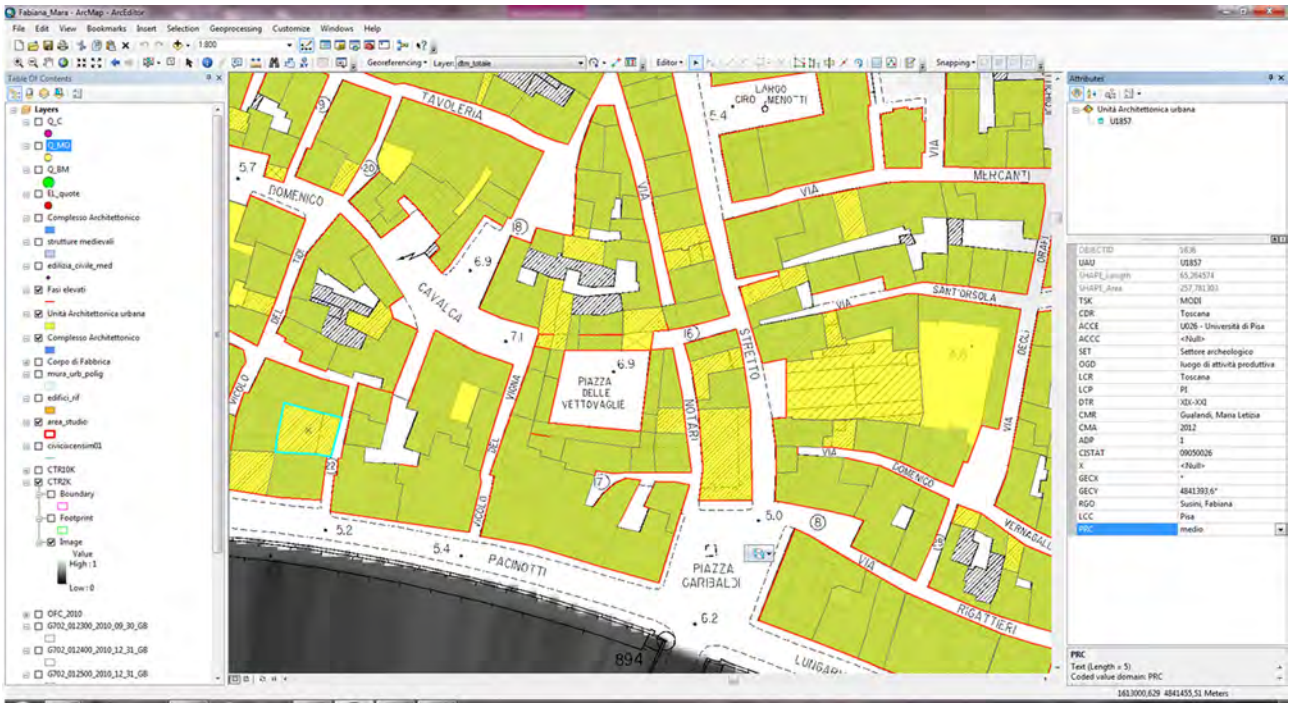


Figure7. Table of attributes in GIS Environment.

of accuracy and 3 the highest level). The probable presence of errors that may be found is due to the fact that the class of belonging of certain UAUs (internal parts) is not known and that certain masonry structures (tower houses) inside larger structures are identified with difficulty: the second work phase will attempt to correct the accuracy of the drawings and increase data reliability.

4. To sum up...

The main aim of the analysis of buildings for the study of the archaeological potential of such a large area of interest was to provide data that could include aspects of the city's urban development – especially starting from the medieval age – in the calculation of the archaeological potential. Thus, the analysis is not only a predictive study of archaeology but also of urban design and of the history of architecture of Pisa. Although we were aware of the possibility to increase and further examine the data acquired and their interpretation, nonetheless we started our analysis in a systematic manner by studying and recording the various historical and typological construction phases for each single element of the city. The large amount of data acquired, available also through webGIS (www.mappaproject.org/webgis), will allow experts to attain new information about the permanent and inherent characteristics of a specific urban context in terms of construction systems, building complexes over time and styles. The data could also be useful for a 3D reconstruction of the historical centre during its various construction phases.

It should be noted that the model may be exported to other environments, although every situation has special features entailing adjustments to names, especially the fields regarding types and functions.

F.S.

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