

## **Archive documents and building organisation. An example from the modern age**

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Written sources offer abundant material to those who wish to study the history of building. One of the possible fields of enquiry is the building site of the past, in various respects.

In general the data to be derived from archive sources can regard technical aspects, organisational aspects and financial aspects. Often it is the document itself or even the datum itself that can provide different types of information, depending on how it is read and processed.

In the paper that follows we have endeavoured to illustrate the information potentialities of archive documents for the study of the preindustrial building site, with the aid of examples referring to the city of Genoa in the modern age (16<sup>th</sup>–18<sup>th</sup> centuries).<sup>1</sup>

Many types of documents contain useful information. Considering just a few of them we can mention building contracts and specifications with relevant project drawings, contracts referring to production, sale and purchase of building materials, testimonies, judgements or court deeds regarding controversies in the building sector, receipts of payments of labourers and materials, estimates, inventories, account books, laws on building, guild statutes, treatises and manuals, deeds of the building magistrature, and so forth.

The different types of document may be more or less useful, depending on the specific objective of the research. For example, it is one thing to seek sources for the history of a specific site and another thing to

seek them for the history of a site in a given epoch and a specific territory.

If the objective of the research is the history of a specific territorial and temporal context, one important aspect of the study of the written source is that the document must not constitute an isolated datum but must be part of a series of documents that is sufficiently complete in time and/or space, i.e. such as to permit interpretations based on fairly large numerical bases.

If data are collected in a systematic way from a large number of documents referring to a homogeneous territory, it is possible to reconstruct the building site in its most widespread modalities and also to identify exceptional cases and moments of innovation.

Through systematic comparison of a large number of documents, one can also study the technical language used, generally characterised by local terms which are often archaic and difficult to interpret. Without a real understanding of the technical language, one risks misunderstanding the real content of documents or neglecting significant parts of them.

### **REALISATION TIMES**

Notarial contracts always set the time for execution of work: in the sample examined it varies from a minimum of 15 days to a maximum of nine and a half

months, with an isolated case of 18 months allowed for the delivery of a big supply of marble elements.<sup>2</sup> For example, to add another floor onto a modest house,<sup>3</sup> a deadline of two months was set: the work included scaffolding, execution of the walls, putting in windows, plastering, execution of the roof surface and chimneys. Two months were also contemplated for various jobs connected with reorganising and restructuring a nobleman's residence:<sup>4</sup> closing off the existing loggia by building an atrium covered by a vault, redoing and widening the stairs, execution of a column arcade on two sides of the cortile, alteration of the windows, putting in new door jambs, plastering and whitewashing of various parts of the house, execution of some floorings and various finishing touches. Lastly, reconstruction of a building of at least three floors above ground, including flooring and plastering, was to be completed within seven months.<sup>5</sup>

These data reveal marked celerity in the execution of work, if the times contemplated really were respected. A confirmation of this —for work, incidentally, that was very big— comes from documentation on work done at the harbour. In the case of Ponte Calvi, one of the disembarkation bridges reconstructed in masonry in the 15<sup>th</sup> century, the work was completed in all details just over five months after the stipulation of the first contracts (Boato et al. 1993, 76).

#### PREPARATION OF THE BUILDING SITE: EXCAVATION, FLATTENING, DEMOLITION

The historical city of Genoa developed on a terrain affected by more or less steep hills and valleys with short watercourses running through them. The site of any construction generally sloped to a greater or lesser extent and was affected by the presence of a rocky subsoil (loamy chalks or marls). Hence setting up a building site frequently meant reckoning with the need to perform excavation or flattening of the terrain, and sometimes also with work for redirecting and channelling water. In the 16<sup>th</sup> century, after the flourishing development of the late Middle Ages, the city within the walls was complete. Hence often the building site often had to come to terms with the presence of older buildings (intact or in a state of ruin), to be demolished or incorporated in the new construction.

Diggings, whether linked to partial land excavation or the realisation of foundations, were entrusted, either directly or by subcontracting, to workers able both to carry out the operations and to take away the material that could not be used or disposed of *in loco*. For this reason we often find contracts given to muleteers.

The costs of digging operations depended on whether the subsoil was made up of compact rock (*scoglio*), marl (*tovio*), rubble (*zetto*) or earth. In the case of mixed situations, every type of digging was evaluated differently. This was related not only to the different effort or difficulty, but also to the possibility of recovering material that might in some way be useful for construction work.

The most precise contracts were full of clauses contemplating all eventualities, not only so as to establish competencies and costs, but also in order to define the execution modalities of every possible type of work. In a contract dating from 1623, for example, it is established that if during the course of the excavation fragments of stone and pieces of brick (so-called *frazzi*) are found that are judged to be still suited for use, these will have to be set aside. However, this will not affect the cost of the operation. If, instead, larger stones are found (defined as stones *da canella*), these will have to be deducted from the volume of the excavation and computed separately.<sup>6</sup>

Earth and rubble, when possible, are used in the construction work itself or disposed of on the property of the client: earth alone and earth mixed with rubble for flattening of the land under or around the building, rubble for filling vaults or for putting under flooring.<sup>7</sup> In cases in which the terrain was of a clayey type (this were rare, seeing the nature of the Genoese soil), the raw material for making bricks was recovered.<sup>8</sup>

In general one notices an attitude of great attention serving to minimise the quantity of material to be taken away. The fact is that in the city there was a problem linked to the risk of silting up the harbour, and a contribution could be made to this both by material dumped in the sea and material deposited in all the area behind the harbour. Hence it was the magistrature responsible for watching over building activity that decided each time what places could be used for disposing of material and established at what distance from the coast and in what stretches of sea rubble could be deposited.

This attention is also reflected in behaviour towards existing buildings. Even when the project contemplated more or less total transformation of the building, efforts were made to reuse everything possible, minimising demolitions and recovering all possible material. Evidently the organisation of a building site had to take all this into account, both at the time of dismounting various parts and in the selection and management of material resulting from demolition. The latter material might have a different destiny, and this is an aspect on which contractual clauses generally dwell, above all to clarify the financial points: recovery and reemployment on the building site, recovery for future reuse, recovery for uses other than building ones (wood for burning), transfer to public tips.

## SPACE MANAGEMENT

### Measurement and storage of materials

Supply on building sites, according to the usual custom, was done on a daily basis (*dietim, ad iornatam*), depending on how the work was proceeding. If suppliers respected their contractual obligations, this made it possible always to have the necessary materials available, without having to allocate big areas for storing them. However, a space always had to be set aside for unloading material, so as to undertake the necessary measurement required for checking the quantities delivered, and so as to have available what was necessary for the work being done.

Timber and iron were stored inside, to protect them perhaps against humidity or perhaps against thefts: this at least is what happened in the work for the New Walls (Bruzzo 1935, 24).

Shapeless stones of medium-small size (so-called stones *da canella*) had to be carefully piled up, to permit a first estimate, on the ground, of the quantities supplied. This operation was called *acanellare*.<sup>9</sup> The measurement and payment of these was in accordance with the volume (the so-called *canella da muri*, equal to 288 cubic *palmi*, amounting to 4.4 m<sup>3</sup>).

In a detailed contract relating to the «Albergo dei Poveri», indications are also given as regards the movement of materials. The building contractor has not only to have stone material deposited on the site, in accordance with the common practice, but is bound

to deliver it to the masons in the places where they are working. Rough-hewn or squared-off stones (so-called *piccate*), characterised by high weight and size, are to be heaped up at the foot of the pilasters that are erected with them and then raised by means of a crane as the work proceeds. By contrast, small stones (so-called stones *da canella*) are to be taken at once onto the scaffolding, to be handy for the masons.<sup>10</sup>

Lime, carried on a mule's back, had to be unloaded and weighed, in order to register the quantities of quicklime effectively delivered. Almost all contracts specify that from the supply agreed on there are to be deducted the *crudi* (stone parts that are not sufficiently calcinated, unsuited to the production of slaked lime), with the implicit admission that a lime which is *buona e mercantile* (i.e. good and suitable for commerce) like that requested might contain some. It is likely that the presence of *crudi* only became evident after slaking and some form of filtering.<sup>11</sup> Only then could the *crudi* be weighed, so as to deduct them from the final calculation. Then the waste material had to be collected, loaded on mules and taken away from the site.<sup>12</sup>

### Water supplies

An indispensable material on the building site is water. Necessary in big quantities for slaking lime, water was also used in many other operations: wetting bricks before putting them in place, wetting plaster to make sure it took hold, tempering iron tools . . .

In some cases water was collected in cisterns which would then serve for later site uses, and in other cases taken from an aqueduct or from wells in the vicinity to the site in the quantities necessary for the various jobs: when the organisation of the site allowed it, appropriate channels could be put in place, and otherwise it was transported by hand or by animals.<sup>13</sup> One can suppose at all events that there was a small supply kept in barrels or something similar, from which workmen could take water for daily use.

### Lime pits

There is quite a lot of proof that on the preindustrial site lime slaking was done on the spot. The Genoa documents too clarify the fact that lime came to the

site in the form of lumps (*motti*), and that labourers, including women, proceeded to bathe the lumps to transform them into slaked lime.<sup>14</sup> Hence it was necessary to allocate a space, inside or outside the construction, for this operation.

Current building practice establishes that it is useful to have a container (*bagnolo*) in which to perform slaking and a pit dug out in the earth in which to pour the slaked lime thus produced, after filtering, to season it. The whole operation could be performed in a single tub, as we are informed by Francesco Milizia and as historical pictures show.

It is a common opinion among authors ancient and modern that, in order to obtain a good product, seasoning must go on for several months, if not years. We have no notices regarding whether in Genoa building practice such seasoning was performed, but it does not seem it could have been very long, seeing that lime supplies were brought every day in accordance with the site's needs (*ad iornatam, daily according to needs*). The presence of several lime pits on one site, in addition to allowing the preparation of a larger quantity of material, permitted a rotational use of pits and hence maceration of the material contained in them. However, in the historic area and in small restructuring jobs or maintenance of existing buildings it is possible that people had to adapt to the small spaces available. Once the work was done, evidently the pits had to be filled in again.<sup>15</sup>

### Preparation of materials

Work was done on the site that often required dedicated spaces: mixing mortars, washing stones, making metal objects, cutting wood and marble . . . Such spaces could be created inside the building or in adjacent free areas. In this case too the type of work and the size of the construction were of some importance: on restructuring sites a covered space could easily be found on the ground floor of the building; in work like the New Walls or the Carignano basilica shacks or shelters were made on purpose.<sup>16</sup>

### Lodgings for workmen

When the building site was in a place that was distant from the town or village or involved a large number

of workmen, also making it necessary to recruit workers from outside, it might be indispensable to set up some lodgings for the workmen themselves. There are testimonies referring to a situation of this kind in the case of the site for constructing the New Walls (1630–32), which at certain times involved over 5000 workers. On that occasion the public administration erected the shacks for the workers to sleep in and for the so-called *bicazze* (canteens, sales points run by the contractors).<sup>17</sup>

## PROVISIONAL WORKS

### Scaffolding

Among the clauses in building specifications we also find ones referring to provisional works. The onus was generally on the craftsman, who had to procure the materials necessary for erecting the scaffolding.

A legal regulation of 1594, aiming to protect the safety of passers-by and to avoid damage to the harbour, prescribes making the scaffolding «very safe and shored up with thick planks and *fassine* both under and around» and gives permission to let it lean against neighbouring houses.<sup>18</sup> The *fassine* (fascines of organic material: canes, small wood or anything similar) certainly had the function of preventing the fall of objects (tools, materials . . . ) and of small rubble or mortar used in construction. This explains the task of protecting the harbour they were entrusted with: the biggest danger for the harbour was the constant risk of silting, to which there contributed all the dissolved materials that the rains could drag along the roads as far as the sea.<sup>19</sup>

We also get indications on the way of erecting scaffolding from pictures.<sup>20</sup> For Genoa there is a famous scene of the construction of the Trebisonda warehouse, Figure 1, painted by Luca Cambiaso in Palazzo Lercari-Parodi.<sup>21</sup> In it we see scaffolding made up of a frame of wood stanchions and crossbeams laid on the ground. We do not see the protective boards mentioned before, but this can be attributed to an artistic need to avoid masking of the very scene to be represented.

In addition to this type of scaffolding, which is comparable to modern scaffolding, there are notices of a type that could be defined as mobile, Figure 2, in



Figure 1  
The construction of the Trebisonda warehouse, painted by Luca Cambiaso in Palazzo Lercari-Parodi, Genova

that it consisted of shelves corbelled on the masonry, to be moved as the building advanced.

To get to the different levels of the building ladders were used, but also, when possible, ramps, as it was easier to carry loads up these.

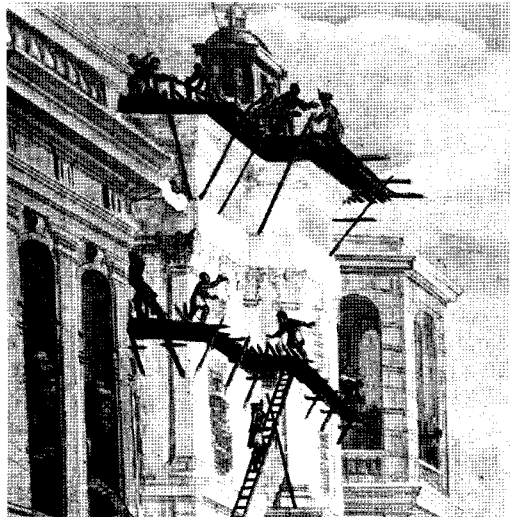


Figure 2  
Giovanni Carlone, villa Spinola di San Pietro, Genova Sampierdarena

The materials used were wood for the bearing structure and the gangways and rope for the couplings.<sup>22</sup> These materials, in particular timber, might be rented for the duration of the work or might be recovered from demolitions.

### Supporting structures

Also as regards provisional work of another type, supporting structures (*ceitri*) for the construction of arches and vaults, notarial documents do not give technical details. The only information refers to the use of planks and the existence of a specific type of nails: so-called *chiodi da seito*.<sup>23</sup>

However, an interesting document exists that refers to the construction of the Carignano basilica (1549 on), done by Galeazzo Alessi. With the aid of a written report and two sketches, Figure 3, Alessi compares two types of timbering, defined as *forma ordinaria* (ordinary form) and *forma straordinaria* (extraordinary form).<sup>24</sup>

The *forma ordinaria* consisted in scaffolding that, by means of a central stanchion, was raised from the floor level to the vault level, where, by means of a tree shape, it supported the surface of the planking on which the vault was to rest. According to Alessi, in addition to being inconvenient because of the space it took up on the ground, it would have cost twice as much as the other and would also have been weaker.

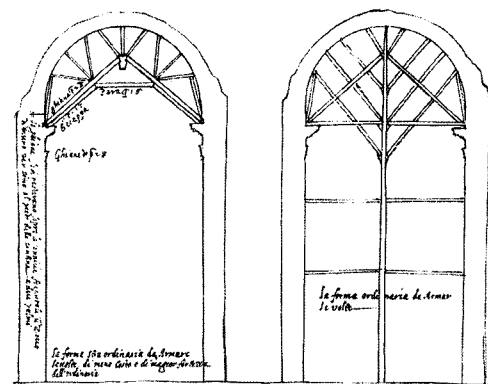


Figure 3  
Galeazzo Alessi, Sketches for Carignano basilica, in Archivio Sauli, 112, 30–11–1560

The timbering to be used, resting on the impost cornices, was constituted by a sort of truss that, by means of a reticule of little beams, supported the necessary support surface.

Of particular interest are the motivations of the comparison: in Genoa the so-called *extraordinary* supporting structure was unknown or little used. It is for this reason, and perhaps to ward off any dissents, that Alessi insists on explaining its advantages and the ease involved in making it. One easily realises the possible influence of a «stranger» in the development of new techniques, as well as in the adoption of new forms. However, while the formal aspect can be analysed afterwards, the use of particular expedients does not always leave traces, and only explicatory documents like the one mentioned can preserve the memory of them.

### Equipment for raising and movement

The richest source for knowledge of the «machines» used on building sites is the pictorial one. Some indications on instruments effectively used in Genoa can be found in written documents too.

Reference is often made to the use of pulleys (*taglie*) and winches (*argij*) with the relevant ropes for raising beams, blocks of stone and any other material which is very heavy and cumbersome.<sup>25</sup>

According to the terms of the contract relating to the «Albergo dei Poveri», the building contractor is to procure everything necessary for constructing the so-called *calandroni* and the trestles (*cravie*) to be used for raising blocks of stone.<sup>26</sup> However, putting the trestles up is a task for the masons. A similar division of the work is found in other contracts.

There are also some interesting indications on lifting machines in relation to the work done at the harbour. When in the 15<sup>th</sup> century it became necessary to prolong the Old Wharf, Anastasio Alessandro, *architectus et magister diversorum operum*, was called in, precisely in his capacity as an expert on site fitting.<sup>27</sup> On that occasion *ruote* («wheels») were set up for lifting big stones, both on land and on the boats used for transporting them (*pontoni*).<sup>28</sup> In the *wheel*, which was hollow, there were one or more men, who set it moving with their own weight, thus succeeding in producing greater force than can be obtained with the winch alone. These *gru a ruota calcatoria* or *gru*

*a gabbia di scoiattolo*, known since the classical epoch, (Gille [1978] 1985; Adam 1984) were normally used in the building sector too, as we can see in various medieval and post-medieval illustrations, and there is nothing to stop us from thinking that they were also used on Genoa building sites.

### WORKERS

On a site of some size in the busiest period there might be hundreds of workmen, each with a precise task and hierarchically divided into workmen with various specialisation<sup>29</sup> and labourers. The latter were not yet skilled workers, and some would never be unless they showed the necessary skill; the client might ask for a limited number of some labourers to be involved, to ensure work of better quality.<sup>30</sup>

The managing role was played by the *capo d'opera* —sometimes helped by a *sotto capo d'opera*— who organised the work and the supplies, co-ordinated the workmen and spoke with the client of his representatives (inspectors, fabric deputies, accountants).<sup>31</sup> In his work the financial aspect was not secondary to the technical one: it was he who took on himself the onus of the supplies in the building contracts for which he was paid a lump sum, sometimes even taking on the role of being a supplier of building materials.

On important sites, where it was the clients who dealt with supplies, the *capo d'opera* presented the list of the days worked for people to be paid, and a bond of trust might live on with the clients even after the completion of the building, both for maintenance and for subsequent work.

The qualification of *capo d'opera* —traditionally taken on each time by those designers who, becoming the building contractors appointed to carry out the work, dealt with managing works— was regulated within the «Guild of the Master Masons» (referred to in Genoa as *Antelami*) and thus became a qualification proper, obtained by means of an examination (Boato and Decri 1995, 26).

A figure belonging to the same guild, though in separate lists from the 17<sup>th</sup> century on (Boato and Decri 1995, ), was the *scalpellino* or stonemason, who worked the stone. His role on the site took on different nuances depending on his specialisation: the

quarrier and supplier of stone material, the breaker of rocks for foundations, the ashlar squarer, the sculptor (who worked above all on white marble: the *marmararo*), the polisher.

Both stone, especially marble, and wood, in the form of planks and beams, required reduction operations by means of sawing on the site; these were performed by *segatori* or sawyers, sometimes on new materials and sometimes to adapt recovered materials for a new use.

The *fabbro* (smith) would appear to be a secondary figure if we think of the use, fundamental but limited, of iron in masonry structures. Instead, his role was constant and basic for the site: he produced every tool with metal components and kept it efficient.<sup>32</sup> He acted on them with steeling (hardening of the surface through the addition of carbon), sharpening and remaking of blades or tips, welding of broken pieces.

The smith also prepared a whole series of special pieces, required at different times, for attaching fittings to walls (*trumeau*, mirrors, etc.), for supporting stucco decorations or for kitchen needs: parts of hearths, and gratings to put at the windows or elsewhere. A noteworthy part of his work was producing nails: up to 35 different types have been found.

For placing *crowns* —the iron tension rods that oppose the horizontal thrusts of arches and vaults or tie masonries together— the smith had to prepare the pieces starting from semi-finished parts<sup>33</sup> that were supplied to him, assemble and connect the various elements and lastly tauten the chains; each of these operations required fire.

Some specialisations in metalworking are that of the *ciavonero*, who dealt with keys, locks and hinges, and that of the *latunaro*, who prepared lead pipes and brass taps.

The *bancalaro* or carpenter played different roles going from the realisation of substantial parts of the construction like floors and roof structures, to finishes like doors, windows and shutters and fittings. The latter work, especially in the case of buildings over which particular care was taken, was part of the site in timing, and was already being done when the edifice was being finished, also because of the relation between architecture and interior design.

If this was quite evident in the eighteenth century, a period in which there was continuity in the decoration of walls and furniture, in previous centuries too a contribution which was not negligible

was made by the various built-in wardrobes, some of them hiding toilets, closed off by panels of wood, often decorated or carved, and the participation in the architecture of a whole hierarchy in the doors, from the most decorated ones leading into reception rooms to the simplest ones leading into service rooms, some of them carefully chosen, in the materials and finishes, so as to withstand thieves and damp better.

The carpenter, like the smith, was constantly engaged in the construction and maintenance of tools and other things necessary for work, like for example the compasses used by other artisans or the handles of various instruments.

In some operations, like attaching door hinges or systems for supporting various construction elements, the stonemason and the smith worked together: the stonemason prepared in the stone the lodging in which the smith positioned the object and embedded it by pouring in lead.

Lastly, there were craftsmen not strictly belonging to the building world who nonetheless played a role on the site too, for example the *bottai* (cooper) and the *vetraio* (glazier). The cooper provided the buckets, pails and vats used for the slaked lime. The glazier prepared the window frames, both with lead and, starting from the 18<sup>th</sup> century, with wood and putty, as well as selling *conche*, *corbei*, *giare*, *bottiglie*, *trombette* . . . i.e. the various glass recipients and glazed earthenware objects, to be used above all by *stuccatori* (stuccoers) and *pittori* (painters). *Calderari* too (i.e. boilermakers), normally busy with saucepans and boilers, were involved for some jobs with copper and brass.

## PROCESSING ON THE SITE

Almost all building materials require processing on the site before or after being put in place, either because of the nature of the material itself (as in the case of lime, which has to be slaked) or because transportation might damage pieces (as in the case of marble or bricks), or because of adaptation to measurements and sections (typical of wood and iron), and of course because many surface finishes can only be done as the last operation (polishing, colouring . . .). In light of the widespread practice of reemployment of materials, we also have to consider all the adaptations of the recycled material.

Starting from the 16<sup>th</sup> century, the stones used in masonry structures were supplied, usually on a daily basis, in various sizes, but were only put in place after selection. At most the mason doing the wall intervened for small adaptations, but his ability consisted precisely in the capacity to assemble an apparently very regular device that yet proved to be very solid (Mannoni 1997). A different case was that of masonries with squared-off ashlar, typical of the previous centuries, which required the patient work of the stonemason to realise the six faces of the parallelepiped which was afterwards to be put in place without particular expedients, unless there was smoothing of the outside face, to be done after assembly.<sup>34</sup>

Stones for finishes or for the decorative parts of structures, like stairs, colonnades and balustrades, balconies, floors, covering surfaces, cornices of apertures and plant were instead supplied in pieces that were more or less semi-finished parts.

In the case of columns, monumental portals or elements like chimneys, whether in Carrara marble (extremely widespread in Genoa architecture) or Lavagna stone, a local slate, each piece was ordered to size; sometimes the system worked even for the exportation of elements abroad.

By contrast, little balusters (in marble), door and window cornices and stone flooring elements (in marble or slate) were produced in a more standardised way, making them to some extent datable on the base of dimensional ratios. The supply of pieces of standard length (Decri 1991), already shaped (*alla romana, piani, lavorati in faccia, refilati*) made adaptation necessary before they could be put in place.

Mention was made above of the work of sawyers on stone and wood materials. It can also be added that in cutting marble, usually a smooth-bladed saw was used with sand acting as an abrasive, and that this instrument needed continual maintenance because it wore out.<sup>35</sup>

Floor bricks needed to be made on the site for perfect fitting, with very thin joints, which could not be done before because of the risk of ruining the edges in transportation. We are referring to *squadratura e fregatura di quadretti* (squaring and cutting of little squares). It is shocking to consider the number of such precision jobs: tens of thousands on a single site.<sup>36</sup> Probably after they were put in place the

last operation on them was polishing, an operation which could be performed with rasps and then *arenino*, used as a fine abrasive.

## NOTES

The divisions «Workers» and «Processing on the site» are written by Anna Decri, the others by Anna Boato (Dipartimento di Scienze per l'Architettura, Università degli Studi di Genova).

1. Archive documents here used come from a database made by the authors during the following researches: *Fonti scritte e fonti materiali per l'edilizia dell'età moderna, Storia dell'uso dei materiali edili a Genova, Tecniche costruttive, manutenzione, materiali, restauri: il caso ligure*, 1988 - 1996 Facoltà di Architettura di Genova (Genoa operative unit coordinated by prof. L. Grossi Bianchi). Researches on the argument of this paper was made in: A.Boato, *Costruire a Genova tra medioevo ed età moderna*, tesi di dottorato in Conservazione dei beni architettonici, VI ciclo, 1995; A. Decri, *Conoscere l'architettura, manufatti nel Settecento genovese*, tesi di dottorato in Conservazione dei beni architettonici, XII ciclo, 2002.
2. Till now data have been processed relating to two hundred 15<sup>th</sup>-century and 16<sup>th</sup>-century contracts.
3. Archivio di Stato di Genova (A.S.G.), Notai Antichi (N.A.), 1032, 1-6-1491.
4. A.S.G., N.A., 1292, 1-6-1489.
5. A.S.G., N.A., 1305, 9-7-1499.
6. A.S.G., N.A., 5829, 7-5-1623.
7. «Intendendo che tutti li zetti ch'avanzerano de riempire le volte della detta fabrica si debano distrebuire nella detta villa» (A.S.G., N.A., 2548, 7-11-1562); «fare portare via parte de quello zeto l'altra parte lasarlo soto l'astrego de deta ciostra» (A.S.G., N.A., 2552, 1-3-1566); «Le terre che si caveranno per questo novo appartamento han da servire per apianare il giardino che si è fatto in pian de saloti di mezzo giorno e doppo definito questo. Il resto che avanzerà farà portare verso la villa alli lochi dove parrà più bisogno e a proposito» (A.S.G., N.A., 4533, 7-4-1614).
8. «Le terre bone (cavate dai fondamenti) servirano per fare matoni. Li gietti e terre cave si giteranno in mare» (A.S.G., N.A., 5987, 14-12-1629).
9. «Dictosque lapides dietim secundum fabrice indigentium consignare in locis propinquioribus dictae fabricae et illos a canella suis expensis congerere et, ut aiunt, acanellare facere. Prætio et mercede [scilicet] illorum a canella librarum sex et [solidorum] 12 singula canella congesta ut supra» (A.S.G., N.A., 5963, 17-9-1619).



10. «Portare le pietre da canella sopra li ponti alli piedi delli maestri in quelle parti dove travaglieranno et le pietre piccate condurle alli piedi delli pilastri dove sarà ordinato e poi a tirarle sopra li pilastri dove li maestri muratori haveranno fatto le cravie per tal'effetto» (A.S.G., N.A., not. Bartolomeo Castiglione, 14–12–1660).
11. In the accounts of Palazzo Gerolamo Pallavicini mention is made of «Un rastello di ferro per uso della fabbrica per la calcina» (Archivio Pallavicini II, 43, 366, January–December 1720). The term *rastello* means «gate». So the *rastello* in question is probably the gate or grid that is placed between the slaking tub and the seasoning pit, for sieving the *crudi*.
12. «Che detta calsina sia fresca, bona e mercantile . . . e che il peso sia sempre fatto nella fabrica dal soprastante nè altrove nè da altri, il quale, giudicando detta calsina bona e della qualità sud.a conforme il peso da esso fatto si debba pagare a ragione di lire 12 il moggio, detraendo però il crudo, con dichiarazione che quando che non vi ne sia più de rubi 4 per moggio non si debba detrarre nel pagamento il quale crudo di più che vi sarà non si debba pagare e doverà esser conosciuto dal soprastante» (A.S.G., N.A., 5639, 8–9–1627).
13. «Stagno consumato in aggiungere li canali nel vicolo delle Merini, ad effetto di fare venire l'acqua per stemperare la calcina nella fossa» (Archivi Pallavicini II, 43, 471, 25–4–1722); «aqua segie n° 45» (A.S.G., N.A., 5658, 6–3–1638). «se al posso vicino a d.a fabrica non vi fusse aqua sarà detto maestro Michele obligato fargliela portare al piè della fabrica» (A.S.G., N.A., 6023, 26–4–1643); Bruzzo 1935, 24–25.
14. «4 donne che hanno bagnato la calcina —dato a uno chi ha sciorato la calcina» (A.S.G., N.A., 5644, 14–6–1630).
15. «Far portar via la terra che sopravvanza al suolo dove adesso è la fossa della calcina a segno che sii a piano dove è detta fossa» (A.S.G., N.A., not. Gio Lorenzo Assereto, 1688).
16. «Fare la baraca per metere la calcina et per impastarla» (Ghia 1999, 304). On the same site there was also a shack for the stonemasons (Ibidem).
17. «Il Magistrato darà comodità di stanze o baracche per li operai e per le biscazze» (Bruzzo 1935, 48)
18. The regulation is inserted in the «Ordini della Camera dei Prestantissimi Signori Padri del Comune» of 15 July 1594 with the title «Non si faccino ponti in strade publiche senza licenza. Con licenza siano ben sicuri» in Archivio Storico del Comune di Genova (A.S.C.G., Atti dei Padri del Comune, 58.
19. An abundant series of decrees regulated the cleaning of streets, the removal of rubble, the emptying of *gabbioli* (deposit pits) existing at the estuaries of streams and of sewers, and works for containing cultivated lands present in the whole hydrographic basin (Desimoni 1885).
20. Rich pictorial documentation can be found for example in Du Colombier 1973; Goldthwaite 1984; Caniato and Dal Borgo 1990. A work wholly devoted to scaffolding is AA. VV. 1996.
21. The palace, in Via Garibaldi, was built between 1571 and 1578. We can mention also the numerous scenes on building subjects depicted in Villa Musso Piantelli at Marassi (beginning of the seventeenth century).
22. «Ha accomodato 17 canteri da 100, 37 tavole da ponte e alquante fascine e una coffa con il corno alto piena di corde che doverà restituire infine» (A.S.G., N.A., 5570, 19–7–1645).
23. We find mentions of supporting structures either in contractual clauses, «se intende che il detto m. Domenico debia provvedere per dicta opera de tutti li ferramenti laborat [ . . . ] coffe legnami ceitri tavole di armari et altre cose che si bizognano per dicta opera», (A.S.G., N.A., 1905, 23–10–1545) or in the lists of expenses: «tabule per fare li cetri dopie e sempie [ . . . ] aguti per li cetri grandi e mezani» (A.S.G., N.A., 1905, 5–6–1545).
24. Varni 1877, 14–16 and table 1, also reproduced in Ghia 1999. The memorial is dated 30 November 1560.
25. «Tagias arganos et cavos sive agumenes pro tirando bordonaria et lignamina» (A.S.G., N.A., 832, 23–10–1454).
26. «Le pietre piccate . . . tirarle sopra li pilastri dove li maestri muratori haveranno fatto le cravie per tal'effetto . . . Similm.te s'obbliga di farle provvedere di legnami per far li calandroni e cravie per tirar le pietre piccate e similmente taglie e cavi e argani necessarij per detto lavoro e non differentemente e similmente provederle di corde per fare li calandroni e chiodi se ne farà bisogno a giudicio del capo d'opera della fabrica». (A.S.G., N.A., not. Bartolomeo Castiglione, 14–12–1660).
27. A.S.C.G., Cartulari dei Padri del Comune, 9, 20/12/1471: registration of a payment «pro expensis factis in legias pontes lignamina et alia opificia excogitata ac designata a dicto magro Anastasio». The same source also mentions various tools for lifting («pro tagijs, pulegijs, pastechis»). The term *taglia* is still used to indicate a lifting machine made up of fixed and mobile pulleys; the *pasteca* is a sort of *taglia* used above all on ships (Casaccia 1851).
28. «Pro circulis 4 magnis ad faciendum rotam in albario; pro caveto uno cantariorum trium et rotulorum 25 pro rota ponthoni» (A.S.C.G., Cartulari dei Padri del Comune, 9).
29. For example in the 17<sup>th</sup> century there were 64 guilds, some of them (*bancalari*, *ferrari*, *muratori*, *serratori di tavole*) peculiar to the building world, but various workers came under the same guild. Cf. A.S.C.G., Magistratura dei Padri del Comune, Arti.

30. «Per fare detto lavoro Bartolomeo vi metta buoni maestri senza garzoni e che al più vi ne sij uno del sotto capo de opera». (A.S.G., N.A., 5137, 8–8–1629).
31. We get an idea of the organisation required by a big site like the Carignano basilica one from reading «Regule e ordini sopra la fabrica»: this document precisely establishes the organisation of the workers on the site and the tasks assigned to each of the people responsible for the financial management and the supervision of the works: the Magnificent Gentlemen Executing the Fabric, the two Deputies of the Executors, the Architect, the Clerk, the Cashier, the Overseer (Ghia 1999, 295–300).
32. The quantity, shape and use of the tools employed by all the craftsmen present on the site still remain to be investigated in depth, one reason being that not all the construction techniques are known. This is a first list derived from the documents examined: *agoglie, punte, picche, picchette, marapiche, picconi, piccozzi, martelli, frapine, badili, zappe, cunei, frappi, martelli, mazzuoli, scalpelli, trapani, tenaglie*.
33. «Fare e consegnare chiave greze a soldi 24 il cantaro di manifatura, chiave di ferro polito a soldi 32 il cantaro di manifatura, chiave vecchie rifare accomodare et agiongere a soldi 32 il cantaro, vele di ferro per il tetto di manifatura a soldi 50 il cantaro, e più ferrate grande e piccole di manifatura a soldi 50 per cantaro, connij di ferro da requadrare pilastri et altro di manifatura denari 8 la libra. Connij di ferro da requadrare pilastri et altro; ferro e manifatura in tutto soldi 2 e denari 8 la libra con patti che d.i lavori siano ben fatti politi et uniti insieme senza crepature e forti di quello istesso ferro che per questo effetto li sarà dato e caso che si rompesseron così prima come dopo d'esser messi in opera per colpa delle manifature perché fusseron in qualche parte mal fatti debba rifarli, et il peso sia riconosciuto dal soprastante». (A.S.G., N.A., 5639, 20–9–1627).
34. «Lapides esse debeant undique quadrati et plani, et cum pacto quod si postquam essent positi in labore protenderent et excederent rectum muri teneatur d.s m.r Nicolosius et in labore aptari et asplanare facere ac reducere ad rectum muri». (A.S.G., N.A., 5965, 22–8–1620).
35. «Comodato una sera per il seratore de marmari adrizzata a caldo per essere frusta al mezo e tagliato al mezzo altra e di nuovo gionta. Frazattura di sega et arena in più volte: palmi 142». (Archivio Durazzo, 478, 1755–1757). *Frazzà* means decrease, disperse, drop, diminish, be partly missing, consume (Casaccia 1851).
36. «Per scuadrare n° 9600 quadretti solo di quadratura per essere statti fregati in gta a conto de suddetto ill.mo signore a ragione di soldi 30 il centinaio £ 144 per n° 27300 sudetti quadretti scuadrati e fregati a scarso a soldi 52 il centinaio £ 709:16 per scuadrare n° 900 quadretti vechij a soldi 16 il centinaio, £ 7:4». (Archivio Durazzo, 477, 8–2–1755).

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