

Constructing Siena Cathedral. Sources and Observations on the Use of Brick in the Middle Ages

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ABSTRACT: As part of the comprehensive research project *Die Kirchen von Siena*, realised by the *Kunsthistorisches Institut in Florenz*, Siena cathedral *S. Maria Assunta* or Our Lady of the Assumption was studied within the last years by an interdisciplinary group of scholars, including art and architectural historians as well as archivists. The appropriate archive of the *Opera di Santa Maria di Siena*, nowadays *Opera della Metropolitana*, is numbered among the richest and most complete mediaeval archives in Italy; it allows a widespread view on the organisation of the building site, on payments and on the providing of material. But the archival tradition needs to be confronted with observations of the building itself – and, of course, converse: Is there an archival evidence for an architectural observation? The paper discusses possibilities and limits of an interdisciplinary research into Siena cathedral, confronting sources and building observations on the use of brick as a both well documented and researched sample.

The material defining best the character of the Tuscan city Siena is brick – just imagine it's that city giving the name for the brick earth around it and, therefore, for the brick's colour. Natural stone like the *calcarea cavernoso della Montagnola*, a light-grey coloured lime stone, was used, due to its high costs in production and manufacture, mainly for the noble's palaces and towers, and later exclusively for special building parts like columns, window frames and cornices. Brick was chosen principally because of the easy availability of brick earth in the surroundings of Siena and of its reasonable price, furthermore it may have been an ancient Roman building tradition as well. Brick was used for the construction of churches, whose façades often were covered later with natural stone like marble in different colours, and for public buildings like aqueducts, city walls, bridges, for the pavement of streets and squares and, of course, for the great mass of burgher houses. Even when we have to think about their façades mostly to be plastered and, possibly, painted, there are indications on face brick walls too.



Figure 1: Ambrogio Lorenzetti: Allegory of the Good Government; (Siena, Palazzo Pubblico, 1337–1339), detail with the construction site of a brick building; (Boldrini 1993, p. 27)

WRITTEN SOURCES

The oldest known reference of brick or tiles in Siena in the Middle Ages reaches back to July 1088, when a property with a house and a wall were leased. The leaseholder obligates himself to cover the roof with tiles or stones, in all probability because of fire protecting (Schneider 1911, no. 114; Ghignoli 1994, no. 83). In January 1112 another house was leased, and, again, the leaseholder agreed to cover it with stones or tiles (Schneider 1911, no. 153; Ghignoli 1994, no. 46).

In 1226 the city donates roughly 15 000 bricks, worth 14 *soldi* and four *denari*, to the hospital of *Santa Maria della Scala* (Biccherna 1914, p. 46), a clear mark not only of the city's tasks but of the importance of the material too. The scove kilns seemed to have been private ones in the thirteenth century, they were located outside of the city's walls like the one mentioned in the statute of 1262, I, 81, close to Santa Regina (ed. Zdekauer 1897, p. 299–300). But more and more local authorities took over the production themselves: In January 1303 the *Consiglio Generale* of the commune of Siena decides the construction of new kilns (ASS, Consiglio Generale 62, fol. 50v), in 1346 and again in 1356 it commands the construction of new kilns close to the city's fountains (ASS, Consiglio Generale 139, fol. 58; *ibid.* 157, fol. 22v), and in July 1360 it orders for workings at the *Sant'Agostino* fountain the use of bricks "que sunt comunis Senarum" (ASS, Consiglio Generale 166, fol. 9v), a mark of the city's own brick production. Yet 1486 bricks of the commune, "mattoni comuni", were carried onto the cathedral.

Even on transportation the commune was worrying about and decides in 1290 to build a bridge to facilitate the traffic from the scove kilns in the Follonica region to the city (ASS, Statuto dei Viari 1290, I, fol. 15v). The transport itself mainly was the task of the buyer, although "portitores vel vecturales" were mentioned in the statute of 1262, I, 467 (ed. Zdekauer 1897, p. 169) and Giovanni Sercambi tells a story about a boy who "con alcune bestie portava li mattoni" (Sinicropi 1972, vol. 1, p. 88). But it appears from a decision of the *Consiglio Generale* from March 1329, that some brick makers transport their product by themselves (ASS, Consiglio Generale 107, fol. 56v).

Municipal statutes

It was *Wolfgang Braunfels*, who firstly mentioned the municipal statutes as "the most important source on medieval building at all" (Braunfels 1953, p. 13; for samples of those studies cf. e.g. Chittolini; Willoweit 1992; Dietl 2000; Tragbar 2003; Keller 2004). Just in its oldest known statute of 1262, I, 495, Siena appoints three supervisors to control prices, quality and production of bricks and tiles. In the very next paragraph the commune terminates the production of six bricks as models, their measures are obligatory for every brick maker (ed. Zdekauer 1897, p. 178), and the same statute of 1262, I, 498 forbids as well the reselling and therefore the speculation with bricks (*ibid.* p. 179). This try of standardisation and quality assurance as one of the town's exclusive sovereign tasks was repeated in the statute of 1297, 4, where Siena intends that everybody producing bricks must strictly attend the measures laid down in a marble work piece kept in the *Biccherna*, a room in the town hall (ASS, Statuti di Siena, 4, fol. 198r–201r) and again in the statute of 1291, 6, 13 (ed. Lisini 1903, vol. 2, p. 548). In the beginning of the fourteenth century the Sienese *Costituto* of 1309/10, 6, 12, for the first time fixes precise measures: "longo per uno mezo braccio et ampio per uno quarro et grosso per uno mezo quarro", which means roundabout 30 by 15 by 7.5 centimetres (*ibid.* p. 547). Nevertheless, mainly in the booming years of the thirteenth and fourteenth century brick makers and merchants often try to fleece their customers with minor measures and minor quality, and the commune was forced to override them over and over again; the lively trade with used bricks may be a sign for the big needs of bricks too. Sometimes Siena stipulates directly the construction of a house, when in the statute of 1262, III, 69, the commune decides within the context of the enlargement of a street to rebuild a house there "de petris vel mattonibus et calcina" (ed. Zdekauer 1897, p. 294), and the *Costituto* of 1309/10, V, 409, commits everybody constructing his house from loam to build at least its pillars and façade out of brick "che cotali case rendano bellezza a la città" (ed. Lisini 1903, pp. 406–407).

Similar rules can be found in other Tuscan towns as well (cf. Tragbar 2006a): In Pisa the *Breve* of 1286, I, 165, decides all bricks made in town and its district to be in their type and measurements like a model kept by the town council (ed. Bonaini 1854–1870, vol. 1, pp. 304–305). In Lucca the statute of 1308, I, 32, stipulates not only the bricks measurements but even quantity and quality of lime, more over this lime must be kept in a special tub. Two men are charged with supervision (ed. Bongi 1867, p. 27). In Pescia too the statute of 1339, II, 77, requires a certain quality for bricks and tiles and decides a minimum weight of 10 *libbre* for each tile and 12 *libbre* for each brick – but maximum measures are not mentioned! All workshops were checked twice a month (ed. Onori 2000, pp. 142–145). Again in Lucca bricks were used for protection against fire, so the statute of *Curia delle vie e de'pubblici* 1342, I, 1, decides in its very first paragraph that every chimney should be "muratus usque ad tectum" and to reach at least 2 *braccia*, 1.20 metres, over the roof; in a wooden house this must be 6 *braccia*, 3.60 metres (ed. Corsi 1960, pp. 43–44; cf. Pierotti 1962, p. 53). Numerous regulations helped town councils to order its townscape, so in Pistoia, where the Podestà's statute (1192–1180), 37.2, promise to demolish brick-built counters on the market square and in some other streets (ed. Rauty 1996, pp. 272–273).

THE CONSTRUCTION OF SIENA CATHEDRAL S. MARIA

Although the above mentioned research into Siena cathedral has brought detailed cognition of the financing of the whole project in the thirteenth and fourteenth century (cf. Giorgi, Moscadelli 2001; Giorgi, Moscadelli

2005), the beginnings in the twelfth century are not very clear. With the *Biccherna* 1226/27, the oldest known, but may be not the first account book of the commune of Siena, we learn that the commune bears a notable part of the total cost; unfortunately we did not know something about the participation of the bishop and the cathedral chapter. Later on, we find documents concerning the construction of Siena cathedral in both archives, the one of the commune of Siena and the one of the *Opera*.

Archival tradition and building chronology

The very first information on bricks in context with the cathedral dates back in January 1270, when the cathedral's *operaio fra' Melano* buys for 350 *lire* a plot of land in *S. Maffeo* with two houses, a vineyard and kiln, most probably for tiles and bricks and a clear mark for the effort of the *Opera* as well to ensure quality and delivery of bricks and tiles (ASS, Diplomatico, *Opera della Metropolitana*, January 29th 1269). Apart from that, great masses of bricks were bought in addition in the first half of the thirteenth century. It was then when the old Romanesque cathedral was to be enlarged by the baptistery *S. Giovanni* in the east and the coating of the transept after 1317 (cf. Haas; von Winterfeld 2006, pp. 454–462). So in the first half-year 1320 the *Opera* buys, besides a certain quantity of ashlar, 10 066 new and 5 100 old and used bricks (AOMS, 171, *Uscita*, *passim*; cf. Lusini 1911, 1939, vol. 1, p. 183 note 4). As just mentioned, this trade with used bricks was pretty common the middle ages; the *Opera* itself uses the selling of demolition waste from houses razed for the in 1339 begun enlargement of the cathedral, the so called *Duomo Nuovo*, to replenish their funds: In July 1339 the chamberlain sells wood, tiles and iron – but not the bricks! – for a sum of 1 046 *lire*, 16 *soldi* and 3 *denari* from such houses (AOMS, 178, *Entrata* fol. 15v), and in 1371 he generates revenues of 75 *lire* and eleven *soldi* from the sale of the building materials of the as well demolished bishop's *loggia*, in detail beams, planks and tiles (AOMS, 196, *Entrata* fol. 30r). The used bricks apparently were required for the building site of the cathedral itself. Interesting, in that period, and up to the mid-fourteenth century, notices are completely missing on the delivery of shaped bricks, needed e.g. for columns (fig. 2 and 3), for the nerves of the vaultings and for the profiled window jambs too, so we do not know whether they are included in the total sum of bricks.

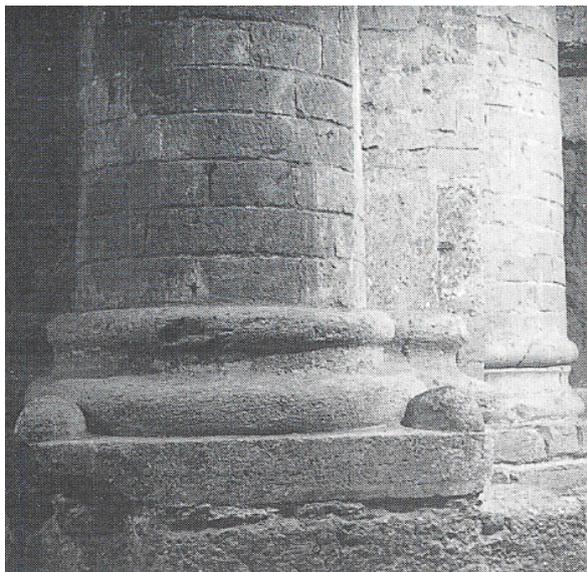


Figure 2 (left): Siena, cathedral, southern substructions, so called fresco's crypt, niggged shaped bricks (Haas; von Winterfeld 1999, fig. 659)

Figure 3 (right): Siena, cathedral, southern substructions, so called fresco's crypt, cutted shaped bricks (Haas; von Winterfeld 1999, fig. 660)

In September, October and November 1335 the chamberlain pays two brick makers for a total of 99 000 bricks, *mattoni*, and 2 500 brick sheets, *pianelle*, which were partially delivered (AOMS, 176, *Uscita*, fol. 41r, 52v, 59r). In the first half-year 1337 the *Opera* purchased 40 250 bricks and 6 000 brick sheets (AOMS, 177, *Uscita* fol. 21r–23r.). In April 1351 a brick maker gets paid for 570 shaped bricks (*bottacci*) "per le volte maggiori" of the *Duomo Nuovo* (cf. Haas; von Winterfeld 2006, pp. 462–471), which means, that the works on the nave of the *Duomo Nuovo* were barely finished – irrespective the Black Death of 1348, which carried off nearly half of the population in Tuscany. Another one delivers 584 *bottacci* for the same use too; in June a larger quantity of bricks were bought (AOMS, 180, *Uscita* fol. 83r, fol. 91r).

Briefly after the abandonment of the hypertrophic project of the *Duomo Nuovo* in 1357, in the budget year 1358/59 bricks, wedges and tree trunks for the construction of gauges for the vaulting of the baptistery *S. Giovanni* were delivered (AOMS, 185, *Uscita* fol. 46r, 50v; ed. Lusini 1911, 1939, vol. 1, p. 239 note 18). Although we cannot find those materials any longer on the building site, the archival tradition helps to understand the building process. In other cases as well the *Opera* provides bricks and other material for construction, so for the casting of bells 1413 (AOMS, 25, doc. 34; ed. Milanese 1854–1856, vol. 2, no. 35) and 1452 (AOMS, 13, fol. 117r, 119v).

Beside the notices of the ordering of shaped bricks we see from the archive, that sometimes bricks were shaped later. In March 1361 the chamberlain pays the stonemason *Ruggeri di Mone* 32 *lire* for the trimming of 1 600 huge bricks for the columns of a chapel close to the hospital, so pre-shaped bricks were not used for this task (AOMS, 188, Uscita fol. 73r.). But this case appears quite rarely in the archive, and in January 1366 a brickworks delivers 820 shaped bricks for the nerves (AOMS, 193, Uscita fol. 42v, 43v, 44r, 48v). In January 1362 several vaultings around the crossing were finished because a brick maker delivers 1 126 Spanish tiles, *tegole maritate*, plus 664 roof tiles without the hip tiles; in April again 150 Spanish tiles were recorded (AOMS, 189, Uscita fol. 64v.). In the budget year 1363/64 bricks, tiles and brick sheets were bought (AOMS, 191, Uscita, passim), in 1364/65 works continues, mainly on the vaulting, so bricks, brick sheets, tiles and tree trunks for scaffolding were bought (AOMS, 192, Uscita, passim), an allocation of the works is not possible. In December 1365 the work on the vaultings continues: 2 050 brick sheets and 7 020 broader bricks, "mattoni larghi per le volte", were bought, in March 1366 again 5 480 broader bricks (AOMS, 193, Uscita fol. 42v, 43v, 44r, 48v). The works on the new roof are not yet finished in 1366, in October and November *maestro Minuccio di Ser Nuccio* delivers in total 55 *braccia* and two *quarri* hip tile from tuff, in addition 305 tiles, 100 hip tiles and 100 Spanish tiles were bought (AOMS, 194, Uscita fol. 37r; cf. Lusini 1911, 1939, vol. 1, p. 311 note 3 with a wrong data). In the years 1372 and 1373 working continues on the roof; beams, gutters and Spanish bricks were delivered (AOMS, 199, Uscita fol. 68r, 71v, 80r, 81, 84v, 89r).

In February 1370 a brick maker delivers two lots with a total of 5 050 bricks for the new chapel of the stonemasons (AOMS, 195, Uscita fol. 59r, 64r).

In the winter 1374/75 the roof of the cathedral needs repairing, from October to February several lots of tiles and hip tiles were bought (AOMS, 203, Uscita fol. 63r/v, 65v, 68r, 70r, 71v; partially ed. Lusini 1911, 1939, vol. 1, p. 311 note 3). In March 1397 again 600 bricks were bought to repair a damaged wall (AOMS, 255, Uscita fol. 62r); on March 2nd the chamberlain *Benedetto di Giovanni* commissions 400 tiles at the brick maker *Francio di Nicolino* from *S. Lazzaro*. The tiles serve to substitute the festered wooden gutters and should be one *braccio* and one ounce long and accordingly broad and should have a high seam of a twelfth of a *braccio*. They should be beautiful, well burnt and seasoned, the price was stipulated at three *soldi* and seven *denari* each (AOMS, 498, fol. 161r). On July 1397 heavy losses were noted at the vaultings of the cathedral due to the ingress of moisture; the worker's council decide to replace the lighter gutters by those of brick sheets, *scuole*, with side walls (AOMS, 498, fol. 164r; ed. Milanesi 1854–1856, vol. 1, no. 107; cf. Lusini 1911, 1939, vol. 1, p. 209–210, 240 note 27). In July 1446 a storm damages the roof of the cathedral, for repairs more than 90 *lire* were needed, rebuilding is necessary for the brick gutters as well (AOMS, 502, fol. 77r–78v, 80r; 559, fol. 14r).

In September 1447 working begins at the *Cappella della Madonna delle Grazie*, two brick makers deliver roughly 10 000 bricks (AOMS, 501, fol. 97r, 103v; 502, fol. 112r).



Figure 4: Siena, cathedral, northern substructions, supporting pillar under the Chapel of *S. Ansanus* (Haas; von Winterfeld 1999, fig. 680)

Precise connections between the archive and the building can be found sometimes, but rarely, like the notice, that in June 1480 a brick maker was paid for 3 375 bricks to be used for the reinforcement of an arch in the priests dwelling underneath the Chapel of *S. Ansanus* (AOMS, 508, fol. 228, 239 right) (fig. 4) – and in the same room, which is not longer used for dwelling, we have a construction which could be identified with the archival tradition.

Not only for construction, for the interior fitting bricks were needed too. In December 1360 the ground floor was laid in the sacristy, 2 400 brick sheets were needed and also clamps for fixing (AOMS, 186, Uscita fol. 57r). From May 1380 to April 1381 the square in front of the baptistery *S. Giovanni* was paved with bricks (AOMS, 213, Uscita fol. 36r/v). In November 1397 works on the completion of the brick pavement in front of the cathedral begin (AOMS, 226, Uscita fol. 54v, 55r; cf. AOMS, 498, fol. 164v with the decision of October 18th), and in 1450 the square in front of *S. Giovanni* was freshly paved with bricks in herring bone as well as the area in front of the *Porta del Perdono* in 1451.

Interesting that we learn from the archival tradition something about lost parts of the cathedral and of its interior. In August 1362 the pavement at the new position of the high altar was laid: A brick maker delivers five some brick sheets, also another brick maker was paid for brick sheets (AOMS, 190, Uscita fol. 5r). Nowadays the whole pavement of the cathedral is a whole mosaic, and all older pavements are lost like the *schuola*, for whose construction 1 000 brick sheets were purchased in July 1373. The *schuola* was a limited area in the cathedral to paint an annunciation (AOMS, 201, Uscita fol. 44v).

Observations on the cathedral

Already one of the oldest parts of Siena cathedral, the crypt under the choir, was mainly build from brick. Though the walls have an outer travertine mantle, the inner mantle consists of bricks with niggged surfaces. Those bricks are characteristic for Romanesque architecture of the twelfth and thirteenth century and widely spread both in Italy and in Germany, the niggged surface is comprehensibly explained as reworking of the brick's surfaces after the removal of the sand of the brick forms (cf. Autenrieth; Autenrieth 1999, p. 120 note 113) (fig. 2). The first of the above mentioned semi columns in the crypt, the one orientated to the north, shows these characteristics too. Interesting, the second semi column, close to the first one and orientated to the west, consists of shaped bricks as well, but has cut surfaces (fig. 3), so we have two different handicraft technologies very close together both temporally and spatial. The three courses high attic base of the second column was build with shaped bricks as well.



Figure 5 (left): Siena, cathedral, northern substructions, north-east corner of the fourteenth century enlargement; (Haas; von Winterfeld 1999, fig. 689)

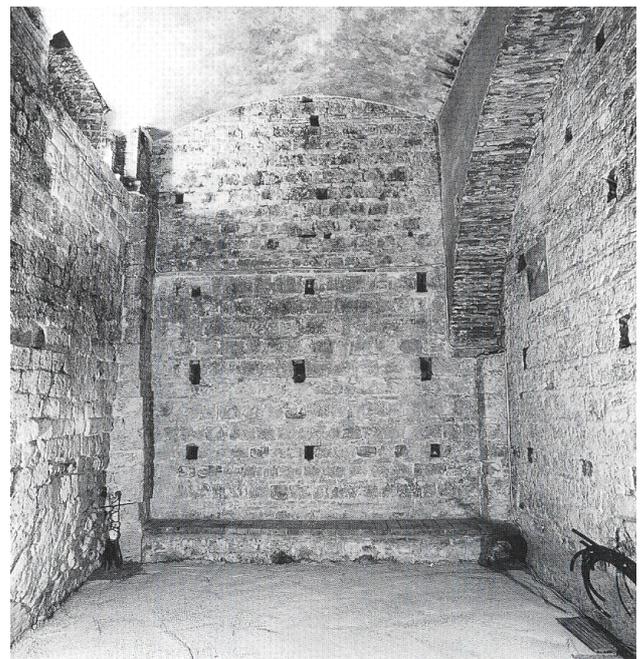


Figure 6 (right): Siena, cathedral, northern substructions, foundations of the twelfth (left) and of the fourteenth century enlargement (front and right); (Haas; von Winterfeld 1999, fig. 713)

The oldest known annex to the cathedral, the so called old sacristy built in the north-eastern corner, consists of brick completely. Though the cathedral's enlargement of the fourteenth century has left only few remaining, its construction is clearly visible: The walls consists of a core of conglomerate stonework with brick mantles. Shaped bricks only were needed for the nerves of the vaultings, from which the beginnings remain; the wall ribs were made from slightly cantilevered normal bricks. The enlargement of the cathedral planned in the first decades of the fourteenth century has walled and as well partly demolished the old sacristy. The walls of the enlargement were laid with bricks, the exterior was covered with marble. Due to some changing in the planning, the interior was never finished, it has neither plaster nor vaulting, so that the whole situation allows a view into construction methods of the fourteenth century (fig. 5). The entire wall structure was laid with shaped bricks. As usual, those bricks have standard size and were cut at the quoin before burning. For the window's jambs bevelled bricks were needed, to lay the obtuse angle between wall surface and jamb without cutting bricks, then channelled bricks, which were used as well for the wall ribs, and rounded ones for boltels or small

three-quarter columns of the jamb's profile. Apart from that bricks for the cornice were produced for the impost moulding, following every step the jamb's profile. Shaped bricks with a special profile were needed for the vaulting's ribs. But on the same level within the northern substructions a foundation masonry is visible of the same fourteenth century enlargement (fig. 6), it has regularly alternate courses in lime stone and brick. The brick course has a height of one brick, the lime stone one is roughly as three times high and consists of small ashlar. Interestingly the foundation masonry of the twelfth century only shows lime stone ashlar and no brick at all. Apart from that, holes for beams we find only in the twelfth century foundations, which is another indication on the development of the medieval construction techniques.

CONCLUSION

Not surprisingly, for a complete view into Siena cathedral – and, of course, into any other building as well – a research of both the building and the archives is absolutely necessary. As e.g. common construction techniques, the treatment of ashlar and bricks surfaces or the composition of mortar as part of the handicraft process are not described in any archival tradition, and, on the other hand, the organisation of the building site, the purchase of brickworks, the recruitment and payment of workers masters or the totals of bricks ordered year by year are not visible in the building itself directly. But a precise measurement of the building, an archaeological building research or, to use the German word, *Bauforschung* should definitely form the basis for any observations on the building. Together those evidences provide an insight into the building progress, and only a concerted view, a confrontation of both sources will allow deepened conclusions on the buildings history.

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Please note: The *braccio* was rounded with 60 centimetres for the sake of simplicity.

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