

## **“To Provide the Old Church with Good Foundations to Prevent Subsidence”: Builders’ Specifications in Amsterdam**

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Despite the relative abundance of historical builders’ specifications and building contracts in the Netherlands, they have never before been studied as such. Such documents have been preserved since the fourteenth century, and they provide considerable insight into the history and development of architectural practice. An initial investigation has turned up about two hundred examples. The purpose of this study is to gain a better understanding of the ways builders’ specifications evolved over time, and of how they were used, in the Netherlands. Builders’ specifications had attained a high level of sophistication in Amsterdam by the sixteenth century. One example deals with the stonework needed for the tower of the Old Church (Oude Kerk) from 1564, including a systematic description of the stone to be supplied from the Meuse valley (GAA, archief van kerken en kloosters, inv. no. 116; Van Tussenbroek 2006, chap. 6). Amsterdam’s civic construction industry, which grew up in the sixteenth century, called for the efficient processing of building orders. Especially in the case of tenders, which were very common, specifications of the work to be done and services to be provided were crucial.

Builders’ specifications have been preserved in Amsterdam not just for major architectural projects but also for many smaller ones. Detailed plans exist, for instance, for a lock in the Sint Anthonisdijk from 1601, drawn up by the town bricklayer Cornelis II Danckerts (1561-1634) and the town carpenter Hendrick Jacobsz Staets (1558-1630) (Meischke 1994, p. 100-22, p. 102). A list of builders’ specifications from 1634 deals with the renovation of a house on Rokin (Van Dillen 1974, p. 55, no. 115); one from 1641 deals with a contract for stone for two houses on Oude Turfmarkt (Otteneheim 1989, p. 82); one from 1650 is about the renovation of a house on Singel (Van Dillen 1974, p. 558, no. 1102) and another, also from 1650, deals with the building of a house on Rokin (Van Dillen 1974, p. 555, no. 1099).

In the first half of the seventeenth century, drafting builders’ specifications was the responsibility of the town bricklayer and town carpenter, and was listed among their official duties (Gerritsen 2004). Besides the city, other institutions and private contractors too relied on such specifications before contracting out work (Van Dillen 1974, p. 674, no. 1437; Meischke et al. 1995, pp. 341-2).

The following discussion focuses on a building project dating from 1731-9, by which time the system of specifications and contracts was highly advanced. It concerned the stabilising of the tower of the Old Church in Amsterdam. The municipal archives (Gemeentearchief; GAA) contain not only documents about the tower’s subsidence and the planned counter-measures, but a variety of designs, specifications and drawings (the specifications were previously published in full in Janse 2004, chapter 2.4, pp. 266-80, 428-9 and 464).

## THE TOWER OF THE OLD CHURCH

The tower of the Old Church was built in the fourteenth century and its height was increased substantially in the sixteenth century (**fig.1**). Given the weakness of the subsoil in Amsterdam and the shallowness of the fourteenth century foundations, this increase in the weight of the building materials was bound to cause problems. At the beginning of the eighteenth century the tower suffered visible subsidence (Wagenaar 1760, p. 735; Van Breen 1949, p. 605). The tower was built on peaty soil; one would have had to dig over 12 m down to find the first firm layer of sand in the city's sodden soil. Although the subsoil was taken into account when building the Old Church, and fascines were used, these did not reach the first layer of sand. From the fourteenth to the sixteenth century, the piles reached only about 5 to 7 m down into the ground (Janse 1993, pp. 5, 34-8). Leaning towers frequently needed to be restored, propped up or stabilised; several seventeenth-century examples are described in Janse (1999). But the method ultimately chosen for the Old Church tower differed from those adopted in the past. While most plans were confined to consolidating the soil, installing piles at the sides and adding buttresses, in the case of the Old Church, it was decided to encase the entire tower in stone. The same system was used in Gouda almost twenty years later, in 1754, to stabilise the tower of the Church of Our Lady. An 80 cm thick shell was constructed around the north side of the tower as a counter-weight, after which a thinner brick casing was built around the entire structure and firmly anchored to the old tower (Glaudemans 1994. pp. 2-3).

There is no reliable documentation of any steps having been taken to strengthen the foundations when the tower's height was extended in the sixteenth century. The higher tower meant greater wind pressure, and more weight pressing down on the old foundations. This, together with the shallow fourteenth century fascines on the weak subsoil, exacerbated structural instability. Another major cause of the tower's subsidence was the replacement of the sixteenth century organ, in 1724, by the present one (Brouwer Ancher 1895; Noach 1939, p. 195). The replacement of the two columns at the north end of the nave, very close to the tower, can be linked to this project. To build the organ, it was necessary to drive piles into the ground in the church right next to the tower. The preparatory excavation work turned up so many flaws in the foundations that the public works department (*fabrieksambt*) decided, in consultation with the burgomasters, to expropriate the graves between the pillars of the nave up to beyond the northwest and southwest crossing pillars and to brick them over (Bijtelaar 1972, p. 60). Other elements were raised in 1726 because of subsidence in the graves (GAA, Archief van de kerkvoogdij van de Hervormde gemeente Amsterdam (1578-c.1965), OK, inv. no. 32). But none of these provisional measures provided a lasting solution to the problem of the tower.

### MEASUREMENTS: 1731

The tower's subsidence must have been clearly visible. It leant towards the northwest and was markedly twisted. This unstable situation prompted the city council to set up an investigation, and the town carpenter Willem van Diede and town bricklayer Dirk Borsman reported their findings on 5 December

1731 (GAA, Archief van de Burgemeesters (1275-1795), inv. no. 555 and GAA, Archief van de Thesaurieren Ordinaris (1490-1824), inv. no. 13, resolutieboek 12, p. 98). Their report yields a rich store of information. They took measurements in various places, both inside and outside the tower, but confined their investigation to the base of the tower, without looking at the inclination of the spire. Their findings showed that the northwest corner of the tower was 9.25 ins. (23.8 cm) lower than the southwest corner (the unit of measurement throughout is the Amsterdam foot of 28.31 cm, which was divided into 11 ins. of 2.57 cm). On the east side of the tower, under the organ, the ground was 6.625 ins. (17 cm) higher than the point on the same axis on the west side. The north-south axis in the tower was level. One difficulty in analysing the measurements is that they were recorded relative to each other; there was no absolute zero anywhere. This means that specifications such as those regarding the pilasters of the organ relative to the tombstones in the church can scarcely be incorporated into the calculations. The researchers reported that the tower was still attached to the church's central roof. From this statement it may be inferred that the shifting tower caused some to fear it might become detached, which would badly damage the roof, walls and vaults.



Figure 1. Tower of the Old Church, Amsterdam.

The angle of the spire to the perpendicular in 1731 can be calculated from the slant of the base and the total height of the tower at that time. Given the base of 9.4 m and the subsidence of 0.237 m at the corner, the tilt angle was 1.25 degrees (height divided by base, multiplied by subsidence). Combining this information with the tower's total height of 240 ft (height based on second measurement: GAA, Archief van de Burgemeesters (1275-1795), inv. no. 555, k1.), it can be concluded that the uppermost tip of the spire was about 1.22 m (4 ft 3.6 ins.) out of plumb in 1731. The measuring procedure was repeated in August 1734 to provide material for comparison, enabling the rate of subsidence to be calculated.

Although the tower was still attached to the roof of the central nave in 1734, this did not mean that the situation had not deteriorated. While the subsidence of the northwest angle had been 9.25 ins. in 1731, it was 11.25 ins. (29 cm) just three years later. The other measurements exhibited a similar progression. It was reported that "The entire tower is 240 ft high, and over its entire height it has tilted slightly more than 6.5 ins. to the northwest". This proves just how rapidly the tower was subsiding. While the tip of the spire had been only 1.22 m from the perpendicular in 1731, this distance was now 1.387 m. In three years the tower had shifted a whole 16.7 cm.

## **PLANS FOR STABILISATION**

The city council decided to look for ways of stabilising the tower. Two sets of builders' specifications were drawn up, one by Sibout Bollard, master carpenter in Amsterdam, and another by Willem van Diede. The events surrounding these plans and the awarding of the contract are not entirely clear. Although the resolutions of the Thesaurieren Ordinaris indicate that the two proposals were dealt with simultaneously, it is possible that Van Diede's plans were drafted after Bollard's were already known (GAA, Archief van de Thesaurieren Ordinaris (1490-1824), inv. no. 13, resolutieboek 13, p. 24). Some sentences in Van Diede's proposal point to a foreknowledge of Bollard's plans.

### **Sibout Bollard's plans**

Sibout Bollard was a wealthy Amsterdam broker and master carpenter (Meischke et al. 1995, p. 106). His plans to restore the tower of the Old Church were highly ambitious (his specifications, calculations and drawings are in GAA, Archief van de burgemeesters (1275-1795), inv. no. 555, k1, stukken betreft reparatie (rechtzetten) van de toren van de Oude Kerk met tekeningen (1731-1735)). To begin with, the new organ would have to be placed on scaffolding and then detached from the tower. After this Bollard planned to construct a good firm base on which to place the hoisting beams with which the tower would be tilted back to the perpendicular. They would be attached about half way up the brickwork of the tower. A second base, a little further away from the tower, served to set up the long struts that would hold the tower firmly in place. This would reduce to a minimum the risk of installing the piles. Three or four rows of piles would then be sunk into the ground around the tower, and more rows added inside the tower itself. The piles would be driven in together, surmounted by cappings, to serve as a base for the new wall. This entire structure would be beneath ground level.

On the south side of the tower, at its highest point, the foundations would have to be laid two feet deeper than on the north side. The foundations could be strengthened underneath with an additional layer of thick lime mortar so that the brickwork would be firmly attached. The intervening space would then be bricked in. This procedure would have to be repeated a number of times along three sides, each time with one layer less, until all the space was filled.

Once the foundations had been stabilised, they would have to be extended over the whole width of the new piles and renewed up to a height of about fifty feet, as indicated in the silhouette in the drawing (fig.2). (Similar solutions were adopted in other seventeenth-century tower support structures, including the tower of St Lawrence's Church in Rotterdam and the Boventoren in Kampen.) The plans referred to the structure surrounding the lower part of the Westerkerk tower, which likewise disguises all uneven places in the base.

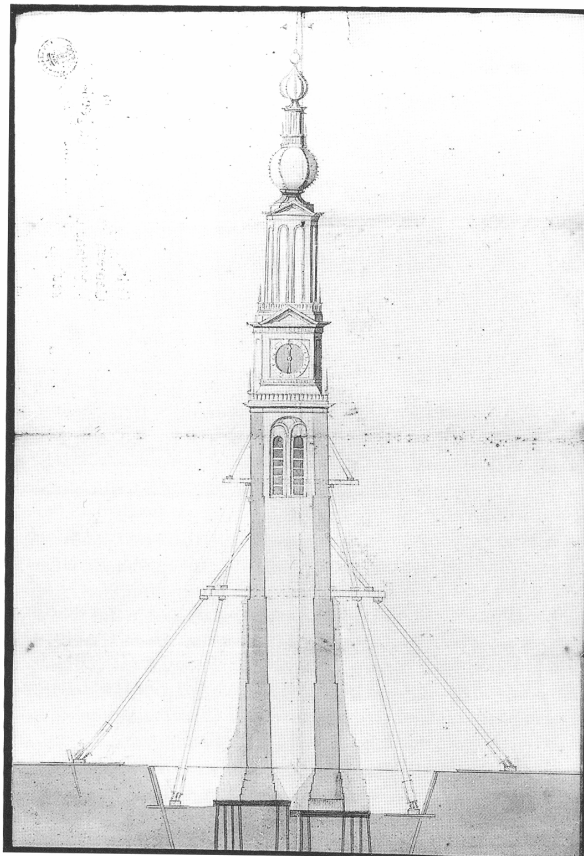


Figure 2. Façade/cross-section of the tower from the west with hoisting beams and struts, belonging to Sibout Bollard's plans.

Only one drawing of the Bollard plans has been preserved, with a view of the tower from the west. It shows the entire tower, together with a cross-section of the foundations. A ditch has been hollowed out around the tower. The drawing also shows how Bollard planned to straighten up the tower. The hoisting beams mentioned in the specifications, which supported the structure that had been attached about half way up the brickwork façade, rested on the ground far beyond the ditch. The struts that were to support the tower higher up, stood within the ditch. According to the plans, the foundation piles would be driven in against the old walls, which would have to be exposed down to the level of the foundations. The drawing shows how the south side of the foundations would be laid deeper than the north. Finally, the silhouette indicates how the brickwork of the planned mantle would be inserted up to the height of the first support beam. Carrying out Bollard's ambitious plans would obviously incur enormous expense: in total, he calculated that 45,500 guilders would be needed.

### **Willem van Diede's plans**

Although the authorities had great confidence in Bollard's abilities, they asked a second architect to submit a proposal. They were probably worried about the expense, since the second proposal was clearly aimed at finding a cheaper solution. The second man they turned to was Willem van Diede, the town carpenter, in which capacity he had already been involved in the measurements made in the tower.

Comparing Van Diede's plan to Bollard's, the differences are immediately apparent (GAA, Archief van de burgemeesters (1275-1795), inv. no. 555, stukken betreft reparatie (rechtzetten) van de toren van de Oude Kerk met tekeningen (1731-1735)). Van Diede did not want to go as far as Bollard: he stated explicitly that he did not want to move the organ, since that would cause

a good deal of commotion in the church and might cause considerable damage [...] Now, it is possible to straighten the tower, but the organ, if it remains where it is, may suffer some damage, [...] since either cracks would be made in it, or it might be dislodged and it would never be as good as it is now, [but otherwise] it would have to be pried loose from the structure, which I judge would not be the right way for the Honourable Burgomasters to proceed.

Instead, Van Diede proposed the following solution: first, the small houses within 9 to 10 ft of the tower (2.5 to 2.8 m) on either side must be demolished. The next stage would be to dig out the foundations of the church tower, on the inside as well as the outside, down to the grillage. On the outside, four to five struts would be erected on one side beneath the first floor, against the beams. These beams would go straight through the tower. The struts would be fixed with braces, as many as necessary.

Six to eight masts would be set up inside, on which to lay beams and to serve as supports under the first floor. The same would be done above the ground floor, as shown in the drawing. The struts used for this should be freestanding, to make the pile-driving operation possible. The piles would have to be sunk as close as possible to the existing work, according to the pile-driving plans, for which a drawing was also

submitted. After one side of the plan had been completed, a frame of wooden beams would be laid on top of the structure. Then the walls could be demolished and rebuilt on the new frame.

After the old structure had been demolished, the pile-driving could be resumed. Cappings would be placed over the piles that would be notched and firmly attached to the masts. The cappings had to be long enough to stretch more than half way through the tower, to provide enough support. The beams would be covered with planks that were 5 to 6 ins. thick. Between these planks, a beam would be placed in the middle of the wall, to prevent the foundations from shifting. Piles would also be driven in inside the church, on both sides of the organ's pilasters, and here too old walls would have to be dismantled. This work would have to be tackled on one side at a time, so as to minimise the risk of destabilising the tower.

More drawings of Van Diede's plans have been preserved than of Bollard's. Accompanying the builders' specifications is a set of seven drawings, which may be divided into three sketches and four elaborated drawings (**figs.3-9**).

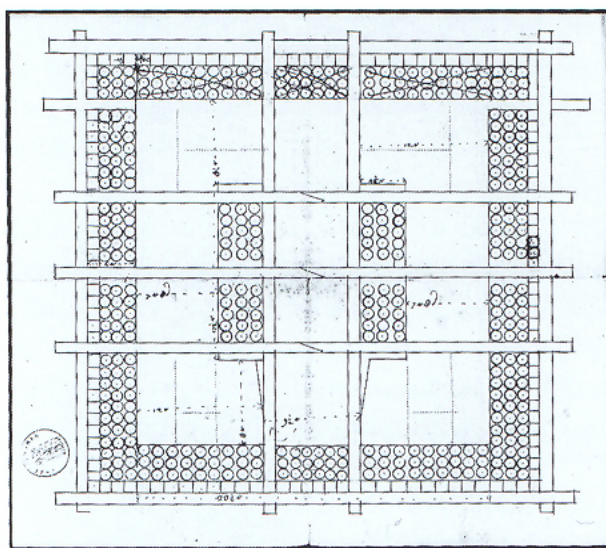


Figure 3. Pile-driving plans belonging to Willem van Diede's plans.

The first three pen-and-ink sketches were probably made by Van Diede himself. This conclusion is based on Van Diede's known handwriting, his style of lines, and the materials (paper and ink) he is known to have used. The first one shows the ground plan for the piles. It indicates the interior and exterior foundations with the beams extending right through the tower. Three sections are crossed out on the east side of the plan, probably because it became clear while the plans were being made that no piles could be sunk to support the tower underneath the organ.

The second drawing, which also shows a ground plan of the piles, took this problem into account. In addition, the plan diverges slightly from the first one. In some sections, new piles would be sunk at different points. The same applies to the number of beams that were to support the tower along the north-south axis. The same drawing also gives a view of the tower from the west. On both sides heavy buttresses were to be added, reaching to a height of about 10 m. For the rest the tower is scarcely shown in detail.

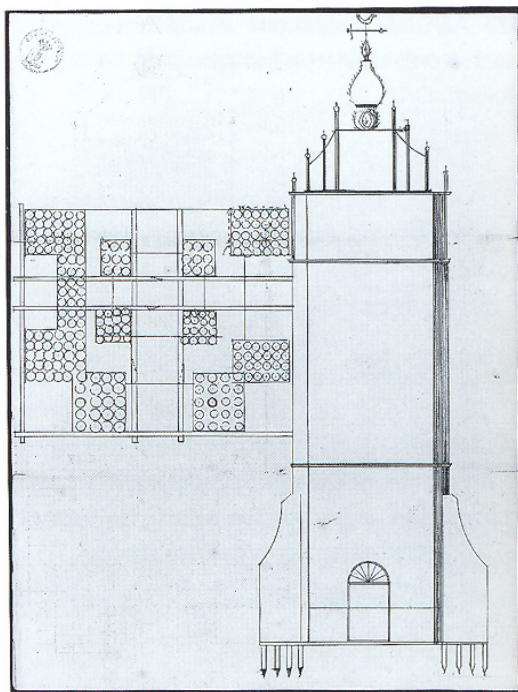


Figure 4. Alternative pile-driving plans and view of the tower from the west, belonging to Willem van Diede's plans.

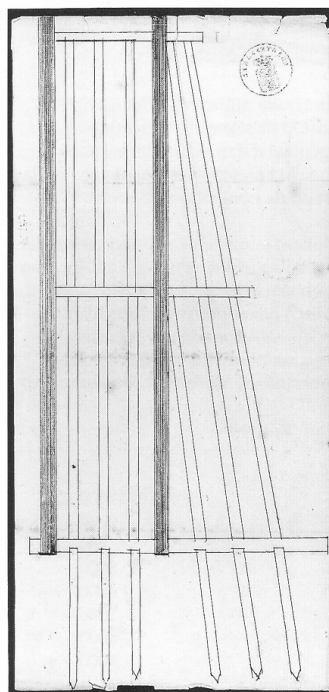


Figure 5. Plans for buttressing the tower during the pile-driving, belonging to Willem van Diede's plans.

The third and final drawing attributed to Van Diede is a sketch of the tower's vertical supports. The tower would be kept in balance while the piles were being driven in by using beams that pierced the structure together with diagonal struts.

These plans were subsequently elaborated in four detailed drawings: two ground plans of the grillage, and a cross-section and external view of the tower, both from the west. The two ground plans of the grillage related to the first and second consolidating layers to be added during the work on the tower. The first layer was to be placed about three metres beneath the eighteenth century ground level. It consisted of a grillage with perpendicular and transverse beams and struts. The second layer, to be



added just below ground level, was almost identical to the first. On the east and west sides, however, the access through the portal was taken into account, so no vertical beams were included here.

In the cross-section drawing, this plan was elaborated in more detail. Above the two ground plans, four horizontal beams were shown in the tower, the middle two supported by struts. The drawing also shows that the plan made provision for the addition of a mantle up to the height of the first three (present-day) sections, up to the belfry-arches. This mantle was attached to the old tower using sawtooth indentations.

The fourth and last drawing shows the design for this mantle, which was to have wide bevelled corners and a gallery at the level of the (present-day) third section. At a height of about ten metres, the coarse bosse changed to smooth masonry.

One of the authorities' main reasons for having Van Diede draft alternative plans was to save money. In his budget he refers to the drawings appended to his plans: he intended to make a grillage and pile system that called for a total of 568 masts. The grillage would extend 5 ft from the base on each side of the tower, and about 220 masts were to be erected under the walls, the number depending on the conditions encountered during the construction work. These masts would be placed 14.25 ins. apart, centre to centre. The planned grillage would have to be laid some 13 or 14 ins. lower on the south east than on the north west side.

Van Diede's estimate came to 19,894 guilders, 43% of Bollard's. Needless to say, the city council opted for Van Diede's plans.

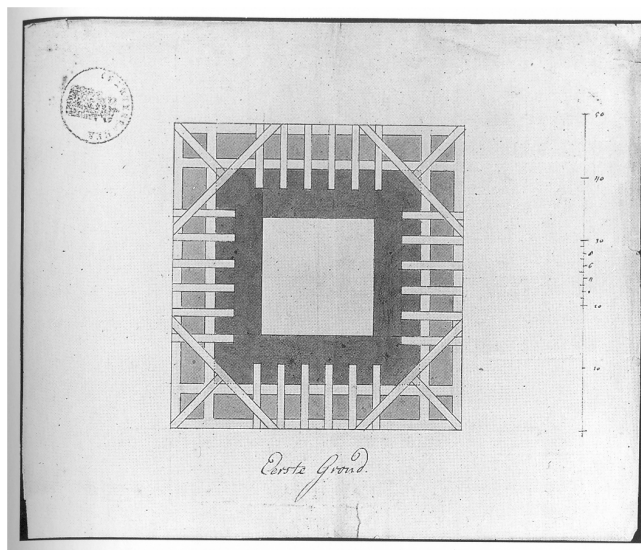


Figure 6. Elaborated first ground plan, belonging to Willem van Diede's plans.

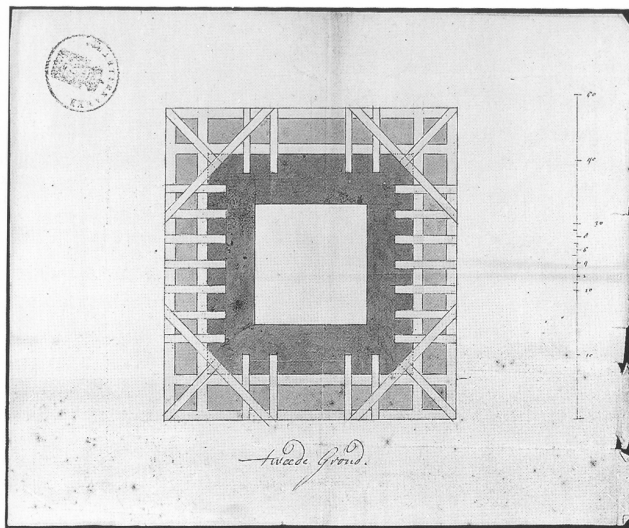


Figure 7. Elaborated second ground plan, belonging to Willem van Diede's plans.

## CONSTRUCTION WORK

By 31 January 1736 the tower had been given struts, the excavation around it was finished, and piles had been sunk below it. So far, 11,818 guilders and 18 stuyvers had been spent (GAA, Archief van de Thesaurieren Ordinaris (1490-1824), inv. no. 658, p. 88; *ibid.*, inv. no. 676, p. 373). The plans were probably adjusted during construction. The progress of the work itself is poorly documented, although we do know that work on the tower started in the spring of 1735, and that it was completed on 12 May 1739 (GAA, Archief van de kerkvoogdij van de Hervormde gemeente Amsterdam (1578-c.1965), OK, inv. no. 32).

No exact records have been preserved of the pile-driving operation. The old grillage was dug out, and besides the demolition of the houses, certain preparatory work had to be done in the tower. The crypt beneath the tower, which was used as a charnel-pit, had to be cleared out, and various pits were dug out in which to re-bury the bones. It was only once all these preparations were completed that the real work could begin.

The pile-driving was probably in the hands of Wijnand van Langen, who had become the city's pile-driving foreman in 1734. He had three pile-drivers at his disposal, which were 54, 50 and 38 ft long, respectively. Each one had three guiding masts and numerous accoutrements such as planks, pegs, chains and ropes. Van Langen also had four rams of different weights. The heaviest one weighed 1 200 pounds (an Amsterdam pound was equivalent to 404 grams), and had to be operated by 60 men. The others weighed 1 000 pounds (50 men), 800 pounds (40 men) and 600 pounds (30

men) (GAA, Archief van de kerkvoogdij van de Hervormde gemeente Amsterdam (1578-c.1965), OK, inv. no. 32).

Piles had to be sunk inside as well as outside the church. In the portal, beams were embedded in the walls at a height of about 4.5 ms. Brick walls about 60 cm thick were then built on the new foundations, right up to the newly installed beams, to give added support. These walls ran from east to west and were built according to Van Diede's second ground plan. Alterations were also made to the entrance and the steps. Traces of the supports used during the pile-driving operation have also been found on what is now the third floor. In the corners, directly above floor level, holes measuring 50 x 63 cm were found in the mediaeval wall structure. These holes accommodated the support beams beneath which the struts were placed. These beams were later removed and the holes filled in with bricks of the same size as those used for the tower's external shell. No such holes were found for a second pair of struts. Reinforcements were added on what is now the second floor in the form of pinewood cross-braces. None of this affected the existing floor levels, however.

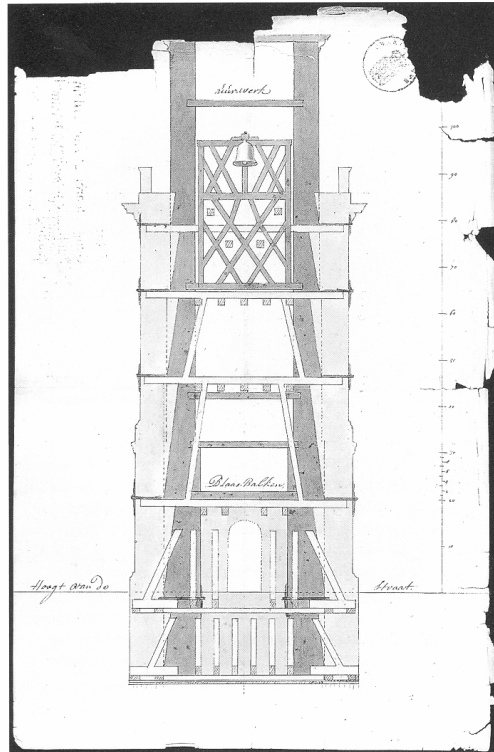


Figure 8. Elaborated cross-section with reinforcements, belonging to Willem van Diede's plans.



Figure 9. Elaborated façade, belonging to Willem van Diede's plans.

## BRICKWORK

After the foundations had been upgraded in the interior and exterior of the tower, the brickwork was added, extending higher than envisaged in the original plans. The north wall was built up more heavily than the other façades. In the interior too, brick walls were built on the foundations right up to the first floor, so that the new walls supported the tower from the inside, reaching up to the beams described in the specifications, which had been installed for this purpose at a height of about 4.5 m and which extended through the entire structure.

The new brick walls, which would eventually extend right up to the gallery, were indented and fixed to the tower. Van Diede's drawing of the cross-section shows the large sawtooth-shaped hollows on the outside of the tower, which were to be filled with new masonry. It is no longer possible to ascertain the precise locations of these indentations.

Van Diede's plan does not describe the mantle's appearance. It simply notes that there should be a plentiful supply of good flat clinkers, cement and lime mortar, "as the work dictated". The drawings tell us a little more about the initial intentions concerning the tower's appearance.

The work was not in fact carried out in accordance with the drawings; instead, the end-product remained closer to the original form. The preference was for a simple design. The old alcove division was retained, with stone being used only sparsely for the belfry and other windows. The mantle of the different façades is of varying thicknesses, becoming thinner higher up. At the present second floor, the mantle is about 70 to 75 cm thick on the north side and only 35 cm on the south. By the top its thickness is only one or two bricks.

Some new windows were added in the course of the work, and surrounded by eighteenth-century bricks right around to the interior of the tower. To link the old and new parts of the structure, heavy, square wrought-iron tie rods were installed over the entire height of the tower, which were later partly endowed with tensioners. The west façades of the side aisles were reinforced when the tower was bricked around. To support the tower, the open angle between the tower and the gable ends of the side aisles was built up higher. The resulting walls were removed again during restoration work in or around 1952.

## **COMPLETION AND EXPENDITURE**

After the piles had been driven in and the new foundations and mantle had been constructed, the tombstone floor in the church was closed up again. Then it was time to tackle the organ. When the Thesaurieren Ordinaris met on 26 March 1739, it was reported that Frans Lijken had undertaken to repair the carvings on the organ for sixty guilders. At the same time, Jacob Husley had agreed to restore the "two capitals atop the two columns" flanking the organ with their foliate motifs and mouldings, "just as they had been before". For this he received the sum of seventy-five guilders; the city bore the costs associated with the scaffolding. Not until March 1742 was the organist Jo van 's-Gravenhage paid for his inspection of the renovated organ. With this payment, the entire project was finally completed.

The last point to be dealt with here is the total expenditure incurred. Although the city council had probably chosen Willem van Diede's solution with a view to economy, the costs ended up greatly in excess of Van Diede's initial estimate of 19,894 guilders. On the one hand it is clear that the plans were changed during construction, greatly increasing expenditure. On the other hand we can assume that Van Diede had kept his estimate as low as possible, hoping to sway the city council in his favour.

The entire operation ended up costing 66,321 guilders and 13 stuyvers – well over three times the original estimate. The provision of precise specifications in advance had not been able to prevent

this. By far the greatest expenditure was incurred in 1737, the year in which the mantle was completely built up and the tower gallery was renewed. It should be added that the original estimate failed to provide for the rebuilding of the demolished houses or the restoration of the organ.

The work did not entirely halt the tower's movements. A study of the walls behind the organ has shown that the old tower subsided another four centimetres after the mantle was installed. After that, it remained in a stable condition. We can therefore conclude that the work conducted in the 1730s was instrumental in preserving the tower of the Old Church.

## **ACKNOWLEDGEMENTS**

The article published here presents the findings of research conducted by the author for the Department for the Conservation of Historic Buildings and Sites in Zeist.

Photographs and drawings from GAA, Archief van de Burgemeesters, inv. no. 555, portefeuille K 1. Stukken betreft reparatie (rechtzetten) van de toren van de Oude Kerk met tekeningen (1731-1735).

Translated from the Dutch by Beverley Jackson.

## **REFERENCES**

### **Municipal Archives Amsterdam (Gemeentearchief Amsterdam; GAA).**

Archief van de Burgemeesters (1275-1795).

Archief van kerken en kloosters.

Archief van de kerkvoogdij van de Hervormde gemeente Amsterdam (1578- c.1965).

Archief van het stadsfabrieksambt (later stadswerken en -gebouwen) (1532-1811).

Archief van de Thesaurieren Ordinaris (1490-1824).

Breen, J van, 1949. "De geschiedenis van de bouw der Oude Kerk te Amsterdam", *Bouwkundig Weekblad* 67, pp. 573-88 and 593-606.

Brouwer Ancher, AJM, 1895. "Een paar rekeningen als bijdragen tot de Geschiedenis der Oude Kerk te Amsterdam", *Oud Holland* XIII, pp. 129-42.

Bijtelaar, BM, 1972. "Huizen aan de Oude Kerk", *Jaarboek Amstelodamum*, pp. 54-74.

Dillen, JG, 1974. *Bronnen tot de geschiedenis van het bedrijfsleven en het gildewezen van Amsterdam III 1633-1672*, The Hague.

Gerritsen, E, 2004. "Architectuurtekeningen. De tekening in de zeventiende-eeuwse ontwerp- en bouwpraktijk in de Noordelijke Nederlanden", unpublished PhD thesis, University of Utrecht.

Glaudemans, AHM, 1994. "Gouda: Onze Lieve Vrouwetoren. Bouwhistorische waarneming". Unpublished report, 's-Hertogenbosch: IBID.

Janse, H, 1993. *Amsterdam gebouwd op palen*, Amsterdam.

Janse, H, 1999. "Het rechtzetten en consolideren van scheefgezakte torens" in Carmiggelt, A et al (eds.), *Rotterdam Papers 10; a contribution to medieval and post-medieval archaeology and history of building*, pp. 117-31, Rotterdam.

Janse, H, 2004. *De Oude Kerk te Amsterdam. Bouwgeschiedenis en restauratie. Cultuurhistorische studies 7*. Zwolle / Zeist: Waanders / Rijksdienst voor de Monumentenzorg.

Meischke, R, 1994. "Het Amsterdamse fabrieksambt van 1595-1625", *Bulletin van de Koninklijke Nederlandse Oudheidkundige Bond* 93, pp. 100-22.

Meischke R et al, 1995. *Huizen in Nederland. Architectuurhistorische verkenningen aan de hand van het bezit van de Vereniging Hendrick de Keyser*; Amsterdam. Zwolle: Waanders.

Noach, A, 1939. *De Oude Kerk te Amsterdam; biografie van een gebouw*, Amsterdam.

Ottenheim, KA, 1989. *Philips Vingboons (1607-1678) architect*, Zutphen: Walburg pers.

Tussenbroek, G van, 2006. *The architectural network of the Van Neurenberg family in the Low Countries (1480-1640)*. *Architectura Moderna* 5, Turnhout: Brepols Publishers.

Wagenaar, J., 1760. *Amsterdam in zyne opkomst, aanwas, geschiedenissen etc.,*. Amsterdam.

