Construction and Destruction of Military Architecture in the Mid-16th-Century Low Countries: Some Observations on Labour Force

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> I think [...] that these ravelins, bastions, curtins, and horn-works make but a poor, contemptible, fiddle faddle piece of work of it here upon paper, compared to what your Honour and I could make of it, were we in the country by ourselves, and had but a rood, or a rood and a half of ground to do what we pleased with; [...] and I will be shot by your Honour upon the glacis of it, if I did not fortify it to your Honour's mind. [...] For if your Honour [...] could but mark me the polygon, with its exact lines and angles, [...] I would begin with the fossé, and if your Honour could tell me the proper depth and breadth, [...] I would throw out the earth upon this hand towards the town for the scarp, — and on that hand towards the campaign for the counterscarp, — [...] and when I had sloped them to your mind, [...] I would face the glacis, as the finest fortifications are done in *Flanders*, with sods, — and as your Honour knows they should be, — and I would make the walls and parapets with sods too; — the best engineers call them gazons, *Trim* [...] — whether they are gazons or sods, is not much matter, [...] your Honour knows they are ten times beyond a facing of either brick or stone; [...] for a cannon-ball enters into the gazon right onwards, without bringing any rubbish down with it, which might fill the fossé, [...] and facilitate the passage over it. [...] I like thy project mightily; — and if your Honour pleases, I'll, this moment, go and buy a pioneer's spade to take down with us, and I'll bespeak a shovel and a pick-ax, and a couple of — Say no more, *Trim*.
>
> (Laurence Sterne, *The Life and Opinions of Tristram Shandy, Gentleman*, London, 1759-67, vol. II, chap. V)

One of the most large-scale building enterprises in early modern Europe was without doubt the transformation of mediaeval city walls into modern bastioned fortifications. The implementation of this new defence system, developed in response to gunpowder artillery, caused an unprecedented urban building activity all over Europe throughout the 16th and 17th centuries, with an irreversible impact on the outlook of cities and their surroundings. For each city, as well as for the entire state government, the building of fortifications always meant a profound and long-lasting challenge in terms of organization and finance, as the needed quantities of building materials and labourers were enormous.

Although the building of these bastioned fortifications and its far-reaching implications on politics and warfare have been given a central place by modern historians in their heavily debated concept

of a 'military revolution in early modern Europe', research on their actual construction remains rather scarce. While the building of 'artillery fortresses' has become an essential chapter in the 'new military history', its place in construction history is still undefined as consistent information on construction techniques, building materials and, particularly, labour force is still wanting.

BASTIONED FORTIFICATION AND THE MILITARY REVOLUTION DEBATE

There is no doubt that the spread of the new fortification system was responsible for a drastic change in warfare. Not only did it necessitate the elaboration of entirely new siege techniques, it also provoked a major increase of the size of the besieging army. In fact, the question to what extent the proliferation of bastioned fortification was directly responsible for the so-called 'military revolution' by causing an unprecedented growth in army size, has recently been the subject of lively discussion among historians (Parker 1988, Lynn 1991, Kingra 1993, Eltis 1995, Rogers 1995, Bérenger 1998, Black 2002). These scholars' renewed interest in warfare emerged after decades of total disregard for military history in the wake of the Second World War and under the influence of the *Annales* school. The insistence on a broader social and economic perspective had led historians to condemn all *histoire événementielle* - and the traditional *histoire bataille*, which indeed dominated the historiography of warfare, was naturally one of their scapegoats. Consequently, practitioners of the 'new military history' began studying the broader picture, emphasizing organization and logistics rather than pursuing the old-fashioned strategic analyses of key 'events' such as battles and sieges. There is an obvious parallel with the growing interest in construction history: architectural historians are increasingly studying the organization and 'logistics' of building practice rather than persisting in the traditional stylistic analyses of individual buildings.

The concept of 'military revolution' is one of the most heavily debated topics in recent historical scholarship. Its way of describing changes in warfare and their consequences has been subject to various criticisms, but the following points are generally accepted. The sixteenth century was of central importance because of the emergence of the 'artillery fortress'. The diffusion of the 'artillery fortress' in the first half of the 16th century chronologically coincided with the rise in army size in France, Italy and the Netherlands (Parker 1996, Afterword). It seems indeed that ever more men and means were required, first, to build the new fortifications and, second, for the mobilization, equipment and maintenance of the besieging armies, so that both became challenging for even the richest states. The theory that fortifications drove up army size has been tested for 17th-century France - and called into question (Lynn 1991) - but the extent to which they drove up labour force still remains unexamined. In any case, the intrinsic importance of the new fortification system (dubbed the *trace italienne* by modern historians) and its module the angle bastion - "the most significant of all architectural forms evolved during the Renaissance" (Hale 1965, p. 466) - passes unchallenged. Apart from dominating European battlefields for three centuries, the 'artillery fortress' also played a crucial role in European expansion elsewhere (Parker 2000).

As the introduction of bastioned fortification played a crucial part in the 'military revolution', the question rises if it did not likewise represent an equally important change in construction history. If

it is true that ever more soldiers and weapons were needed to reduce a modern fortress, one wonders if there were also ever more labourers and tools needed to construct it in the first place, if the supply of these 'armies of labourers' were equally challenging for a state at war, and how such an increase in men and means may have affected building practice in general. Such a study of the labour forces and the volumes of material required for the building of fortifications, lies at the intersection of the interests of military and architectural historians, but has largely been neglected by both. If, to the architectural historian, it is evident that the design of defence works was determined by the assailant's increasingly powerful siege techniques, it remains for the military historian to examine whether the labour forces engaged in building them likewise reflected the increasing size of the besieging armies.

It can be taken for granted that "with this growth [in the size of sixteenth-century fortifications], of course, came an exponential increase in the volume of material required for construction and of the labour needed to place it" (Pepper 2000, p. 16), but the first outline of this increase in men and means still has to be drafted. An exponential rise in size of labour force and material in military construction would obviously raise further issues related to building practice, not only as to the construction site itself (organization of the labour force, supply of material, financial control of the works, standardization of construction techniques), but also as to its broader social and economic impact, on the building market itself (production of building material, competition between contractors) and society as a whole (employment, raising of taxes) (Soly 1970, 1976, 1979).

A major problem when studying the 'logistics' of military construction is the fact that a large part of its building activity concerned temporary earthworks, which seldom left any traces on site or on plans, and only occasionally in documentary evidence such as the accounts or the writings of contemporaries. Several aspects of sixteenth-century military (earthwork) construction have, for instance, recently been studied for Italy, and Tuscany in particular (Lamberini 1986, 1987, 1991; Pepper 1986, 2000), in part based on the detailed description of earthwork technology in G.B. Belluzzi's *Trattato di fortificazione di terra* (written around 1545). Valuable knowledge on how the new fortifications affected building practice is thus provided, ranging from the hierarchical organization of the workforce to the new building techniques adopted for earthwork construction, but precise information on the actual size of the labour forces remains sparse.

This modest paper cannot possibly address all the issues raised; its purpose is merely to provide a few indicative figures. It has been ascertained that the lands of the Habsburgs and of their neighbours (Spain, Italy, the Netherlands and France) were the heartland of the military revolution (Parker 1996, p. 24), in which the sixteenth century furthermore constitutes a chronological centre of gravity. A study of the logistics of construction and destruction of fortifications during the war between the Low Countries and France around 1550 would therefore provide a good test case for the model of the military revolution.

Several other consequences of the changes in warfare during the first half of the 16th century have recently been studied: from Charles V's strategy, politics and finance (Tracy 2002) and

organizational problems of his state apparatus (Blockmans 2003), to the general impact on government and society (Potter 1993). For the Low Countries in particular, attention has been given to the impact of Charles V's wars on society (Cools 2001) and on the territory's defence policy (Roosens 2005). At the same time, the architectural history of fortifications in the 16th-century Low Countries has recently been outlined in various overviews (Van den Heuvel 1991, Bragard 1998, Roosens 1998 and 2000, Van den Heuvel and Roosens 2000 and 2003, Parisel 2002, Roosens 2005). Well-documented case studies of individual construction sites on the other hand remain sparse (Soly 1976 and 1979, Van de Putte 1985). Ongoing research is shedding new light on specialized 16th-century construction techniques (Geleyns and De Jonge 2003) and on military building technology in particular (Geleyns 2003), but its logistics largely remain to be studied.

CONSTRUCTION OF FORTIFICATIONS

It has been estimated that from the 1530s to about 1570 the Low Countries witnessed the construction of 12 entirely new city walls, 4 citadels and 18 partially new enceintes, representing a total length of roughly 43 kilometres of bastioned fortification (estimate by Roosens in Brulez 1978). Throughout this period, a steady increase of both the number of military construction sites and the total expenditure on fortifications has recently been demonstrated (Roosens 2005). In the 1530s, work was done at over 25 sites and already 7 times more money was spent on defence works than in the 1520s. In the 1540s, when over 32 sites were being fortified, the total expenses on military construction once again increased fivefold. The expenditure on fortifications doubled once more in the 1550s, as defence works were being constructed on a total of nearly 50 sites. Determined to be sure by the ongoing wars, the expenses on fortification could still vary considerably from year to year depending on the actual works under construction (an absolute record for the entire period was reached in 1555 when three entirely new fortresses were built), and so they did not always closely follow the rhythm of war and peace. In 1551 (a year of peace), 16% of the total expenditure on the defence of the realm was spent on the building of fortifications, and about the same amount of money continued to be spent on fortifications annually throughout the following two years. In 1553 (a year of intensive warfare), the same share represented only 4% of the total expenses on defence, as these had by now increased fourfold due to the vast expenses on garrisons, artillery and provisions (Martens 2006). A great deal depended on the urgency of the works, and this also determined the size of the labour force. The number of workmen recruited basically depended on the amount of work planned and the completion time envisaged, and varied greatly, from a few tens to several thousands of labourers.

The accounts of the construction of the new town wall of Breda (Roosens 1980) allow us to estimate that during eight years (from 1531 to 1538), on average, no more than about 60 workers were continuously digging and shovelling, each year from March to November, to erect a new circuit of earthen ramparts with a circumference of about 3,5 kilometres and equipped with three bulwarks in masonry (nine more bastions were added afterwards). At Namur, the completion in one

year (from August 1542 to August 1543) of a new curtain wall - roughly 100 metres long - and two bastions, all faced with masonry, required as much as 800 or 900 workmen, the vast majority of which were unskilled labourers digging and hewing stone (Roosens 1998). In Ghent, the construction of an entirely new citadel took five years time; started in May 1540, the fortress was largely finished in 1545. Its four curtain walls - adding up to 1 kilometre - and four angle bastions were all faced with masonry. Their construction required the employment, from the very beginning of the works, of between 3000 and 4000 workmen (masons, artisans and day-labourers for digging) (Van de Putte 1985).

Exceptional in Europe were the simply vast new city walls of Antwerp, with a total length of about 4,5 kilometres, boasting nine bastions and five monumental gates, everything built in brick and white stone. Started in August 1542, the new circuit was largely finished by the end of 1553, thanks to a significant acceleration of the works from 1551 onwards, when an average construction speed of 2640 m of masonry a month was reached (Soly 1979). The accounts do not reveal the exact number of workmen employed, but its designer, the Italian engineer Donato de' Boni, had stipulated that at least 2000 labourers were needed just to start the works. From the beginning it was decided that from every Antwerp household one person (man or woman) had to work on the fortifications one day a week, and for a city of over 70 000 inhabitants this indeed comes down to about 2000 labourers a day. This figure should be seen as a minimum, as in 1551 it was said that "many thousands of persons" had been paid every week since the beginning of the works, and as, for instance, the comparatively modest work on two channels in the new city expansion already occupied about 500 labourers (mostly diggers) during five months. Two decades later, the construction of Antwerp's famous citadel would require a workforce estimated at nearly 1000 labourers - over 300 masons and over 500 unskilled workmen for digging - working full-time during 4 years (from October 1567 to June 1571); early 17th-century historians even speak of 2000 workmen (Soly 1976).

The previous examples are all set in an urban context, and concern mostly fortifications constructed in masonry. Building circumstances were essentially those of any large construction site in a city, where large quantities of labourers were at hand, where building materials could be produced nearby and where supply networks were well established. The works largely had to be financed by the city itself, which usually lay at a safe distance from the actual theatre of war. As a result, completion times could be rather long, and even whole periods of complete inertia were no exception.

Conditions were totally different for fortifications built at the front during wartime, 'in sight of the enemy cannon'. These were often emergency works, thrown up in earth as quickly as possible only to be covered in masonry at a later date. Rapid advance of the works was of vital importance, not only to avoid sudden capture by the enemy, but also to allow the own army to move on as it often remained pinned down on the spot to protect the works until they were in state of defence. Due to

this urgency, the labour force needed was always enormous, and the numbers of workmen requested invariably proved to be too large for sufficient recruitment at short notice. As sudden demands for workers - skilled but especially unskilled labourers - far exceeded supply, special measures were taken: usually, the recruitment of labourers in the neighbouring countryside included even woman and children; if necessary, local authorities were even allowed to force all vagabonds and "useless people that still could serve", to enrol for the building sites (Roosens 1998, p. 195); very unusually, the soldiers themselves were forced to help digging.

When construction of the new frontier fortress of Philippeville was started, in late September 1555, as much as 5000 labourers were to be recruited from the neighbouring provinces in order to have the stronghold in state of defence after winter. Within three months, a circuit wall of 1.5 kilometres and five bastions had to be erected in earthwork; their revetment in masonry was a concern for later. The government requisitioned the needed skilled workmen (at least 100 carpenters and 40 sawyers) as well as 300 carts for the transport of tools and provisions to the construction site. In addition, measures were taken in order to boost the recruitment of the workforce. The wage of the pioneers was raised by 20% and their conditions improved; these unskilled labourers were now even dubbed "manouvriers" instead of the condescending "pionniers". In doing so it was hoped that "poor people, women and children from the surroundings" would come "to ask to carry the basket" (for earth shifting). Nevertheless, much less labourers than the originally envisaged workforce actually arrived on site; when in January 1556 a garrison of 2500 soldiers entered the stronghold, its fortifications were not yet finished (Robaulx de Soumoy 1859, Roosens 1979). For construction of the new fortress of Hesdinfert, started in September 1554, 600 skilled labourers (dykers) and 25 overseers were at first recruited, but already a month later the recruitment of 1000 to 2000 more dykers had to be ordered. There remained however a severe labour shortage so that, as time pressed, the soldiers themselves were now exceptionally instigated to help digging. But despite the example set by the captain general himself and the promise of extra wage, some still refused as digging was considered to be far below a soldier's dignity (Roosens 2005).

Aside the building of a few entirely new fortresses, a large part of military building activity was devoted to the constant reinforcement of the already existing strongholds, but it is evidently much more difficult to asses the labour forces employed in this intermittent process of fortification. A general impression can however be derived from the following report, from the other side of the border; a survey, dated 1544, of the fifteen fortress-cities in Picardy which constituted the defence of the northern French border against Charles V's Low Countries. Aside ample details on the quantities of artillery pieces required (Contamine 1964), the report specifies the various modernization works to be executed on the fortifications of these strongholds during the following months. No precise figures for the required labour force are given, but an overall idea of the number of *pionniers* that were requested can be grasped from the amount and diversity of tools that were ordered (BNF, MS Fr. 5195). For works on 12 fortresses, a total of some 28 400 instruments were deemed necessary. These were, roughly: 7600 baskets and panniers, 4550 iron-headed shovels,

3000 wooden shovels, 4300 picks, 3900 mattocks, 1300 spades, 1550 slashing-knifes, 1000 axes, 1000 sickles and 230 scythes. As the numbers of baskets and shovels show, this assortment of over 28 000 tools was well enough to keep a workforce of at least 15 000 labourers fully equipped. This would come down to an average of over 1000 workmen per place, a figure which is confirmed by the specific request by one of the larger construction sites, Landrecies, for 1500 pioneers.

The problem with such paper figures is that there usually was quite a discrepancy between the workforce requisitioned and the number of labourers that actually arrived on the construction site. For the demolition of the fortifications of Thérouanne in July 1553, which under the circumstances had to advance as fast as possible, it was stipulated that as much as 8000 pioneers were to be employed immediately, for a period of six weeks. But after the first week, the superintendent of the works was complaining of having only 3000 pioneers at his disposal and, one more week later, still not half of the amount requisitioned had arrived on site, and more and more were deserting every day. It seems that despite all efforts of recruitment far and wide no more then 4000 labourers, at the most, could be gathered. One has to add however the unknown but large quantity of manpower, not on the payroll, that was freely taking away old building material, as had been consented in order to speed up the demolition works (Martens 2006).

DESTRUCTION OF FORTIFICATIONS

Enormous workforces were indeed engaged in the destruction of fortifications, particularly during a siege. Around 1550, the number of pioneers associated to the army in the Low Countries was set at 3000, but in practice between 2000 and 5000 were recruited for a campaign (Roosens 1979). At the famous siege of Metz in 1552, mounted by the exceptionally large army force of 55 000 men, 7000 pioneers were allegedly present (Zeller 1943). Apart from the construction of permanent fortifications, it was the pioneers' job, at a siege, to assist in transporting the heavy cannon, to raise temporary earthworks shielding the army, to install the gun platforms, and to dig the trenches and mines. By there very nature, the pioneers' precise work as well as their number are often left undocumented, but an idea of the labour force they represented can be grasped from the quantity and diversity of tools they used.

One of the earliest theoreticians to provide useful data on the subject was Simon Stevin: his *Castrametatio, dat is Legermeting* [the Marking out of Army Camps], published in 1617, describes in full detail the composition of Maurice of Nassau's army of around 1610 (Schukking 1964, Boffa 2004). Principally concerned with the layout of an army camp on site, Stevin first gives a complete inventory of the men, horses, wagons and all sorts of equipment present in the regiments. The army described counts over 15 000 soldiers (12 450 infantrymen, 2855 cavalrymen). The artillery regiment, holding 15 cannon, already includes 25 miners and 100 pioneers, responsible for the transport of the guns and the installation of their batteries during a siege, for which they had at their disposal some 400 hand-tools (50 spades, 50 shovels, 50 axes, 50 hand-axes, 50 slash-knives, 22

picks, 22 pickaxes, 80 wooden levers, 18 iron hand spikes, 2 hand pile-drivers). The real corps of pioneers - those digging the trenches - was not part of the army proper and so their figure is not specified. Their large number can however be deduced from the huge amount of tools they required, enumerated by Stevin in his *Lyste, Vande munitie van Oorloogh* [List, Of the War-munitions]. He remarkably lists a total of 15 900 hand-tools (*Handtreetschap*), a sizeable figure which even exceeds the total number of soldiers - officers and cavalry included - in the army itself. These are: 10 000 spades, 2000 shovels mounted with iron, 1000 pickaxes, 500 picks, 1200 axes, 600 hand-axes and 600 slash-knives. In addition, 1000 wheelbarrows are mentioned. It can be estimated that transport of these instruments alone would require about 82 wagons (27 wagons to carry the 12 000 spades and shovels, 15 wagons filled with about 4000 picks, axes and the like, and 40 wagons carrying the 1000 wheelbarrows). The actual work of the pioneers was described by Stevin in one of his unpublished treatises, *Vant Belegheren der Steden en Stercten* [Of Besieging Towns and Fortresses] (Schukking 1964). For each subsequent phase of a siege, he discusses the layout of the approaches and the techniques for digging trenches. He even invented a new digging tool, the so-called *spabijlhouw*, a combination of a spade, an axe and a pick. Stevin does not give figures for the labour force needed, but seems to imply that as many labourers as possible should always be employed. Thus, for a trench of over 7000 feet to be dug overnight to approach the counterscarp, and with sappers being spaced at 5 feet, one simply needs 1400 sappers to do the job as quickly as possible.

It obviously remains to be seen to what extent Stevin's early 17th-century codification still reflects mid-sixteenth-century practice, but comparable figures of pioneers and tools were indeed present, for instance, during the campaign of the sieges and destructions of Thérouanne and Hesdin in 1553 (Martens 2006). At the start of the campaign, the army investing Thérouanne, numbering 30 000 soldiers, counted 3000 pioneers. After a month of siege works, a thousand more were recruited, as already 300 had been killed, and as many wounded, in the trenches. Furthermore, pioneers were continually deserting, so that at the town's capture, no more than 2450 pioneers, including wounded and sick, and 400 miners passed muster. As already mentioned, over 3000 extra pioneers soon arrived at Thérouanne (8000 had been requested) to carry out the demolition works, while the others followed the army to lay siege to Hesdin. The army now had a total of roughly 6000 pioneers on the payroll, which was only about half the amount it really wanted to have in service. Equipment of this small army of labourers presented a challenge on its own. During the siege of Hesdin, an artillery officer reported: "we are denuded of pioneering instruments, even of picks and shovels of which we have most need [...] we have broken and ruined many of them because of the stony ground", and as much as about 12 000 new ones were demanded. Throughout the five-month campaign of Thérouanne and Hesdin, from April to September 1553, the pioneers used a total of about 20 500 tools, to wit (rounded off): 6700 shovels, 5000 picks, 4500 mattocks, 2000 baskets, 1500 axes and 800 spades. Roughly half of these tools were worn out to the point of being no longer usable; only 11 500 pieces were recuperated afterwards. It is also noteworthy that, in both cases, the demolition works after the towns' capitulation occupied about the same number of pioneers and took precisely

as long as the sieges themselves. Thérouanne was captured after seven weeks of bombardment and mining and it took another seven weeks to completely demolish its battered city walls. The smaller and less well fortified town of Hesdin was taken after a two-week siege, while two more weeks were needed to tear down its already heavily ruined castle.

In conclusion, in the mid-sixteenth-century Low Countries, at least 10 percent of the army consisted of unskilled labourers, but as the job of these thousands of pioneers was invariably harsh, badly paid and dangerous, their recruitment always presented difficulties and usually fell short. The enormous labour forces employed, in combination with the newly developed practice of building in earth, turned the construction and destruction of fortifications into a very dynamic matter. Cities were entirely demolished and new ones erected in a matter of just a few months. In addition to the size of the besieging army itself, with its impressive train of artillery and ammunitions, the large quantities of pioneers and their equipment help illustrate that the siege of a fortified town or fortress was indeed "the greatest engineering venture of early modern Europe" (Parker 2004, p. 6).

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