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Nineteenth-Century Labour Figures for Demolition: A Theoretical Approach to Understanding the Economics of Re-use

Simon J. Barker

Introduction

Recycling has been a feature of architecture and building industries throughout the ages. During the Republican and Imperial periods in Rome, while fresh supplies of building materials and decorative stones were being introduced to the city in ever-increasing quantities, much was also being salvaged and processed for re-use (Pensabene and Panella 1993–1994; Brandenburg 1996; Kinney 1997; Barker *forthcoming*). To-date however, only the more striking manifestations have received detailed attention, such as the re-use of large-scale architectural elements and reliefs, termed *spolia*, on the Arch of Constantine and other later Roman monuments, and the impact of *spolia* on Late Antique and Medieval architecture (Esch 1969, 2005; Deichmann 1940, 1975; De Lachenal 1995; Fabricius Hansen 2003; Kinney 1995, 2006; Bernard *et al.* 2009).

Re-use has often been associated with economic hardship and social decline (Berenson 1954: 14; Deichmann 1975: 24–26, 91–101). In the context of the Roman Republic and Empire, however, such a view is inaccurate. The salvage and re-use of building materials by Roman builders of the imperial period was a crucial process with clear economic benefits, as large-scale demolition could provide substantial material gains. At Rome, for example, the material from demolition work carried out during the construction of the Aurelianic walls took over two centuries to finally exhaust (Coates-Stephens 2001). In addition, it is estimated that roughly 2,000 tombs at Aphrodisias must have been dismantled in order to yield the total 25,000 m^3, or *c.*100,000 blocks, required for the construction of the city walls in the fourth century A.D. (De Staebler 2008: 288). Indeed, the persistence of recycling throughout the Roman period indicates that those involved in the exercise found it both economical and worthwhile.

Quantifying the cost or benefit of re-use, however, remains problematical as ancient sources reveal almost nothing of the trade in second-hand materials (Phillips 1973; Garnsey 1976; Pensabene and Panella 1993–1994: 112–113; Alchermes 1994; Kinney 1997: 120–124). Brenk has stated that 'such a transference of building was by no means inexpensive, let alone practical', asserting that 'it is far more difficult and inconvenient to work with *spolia* than with newly made, homogeneous building materials' (1987: 106). But exactly how expensive or difficult demolition was remains to be answered. In the absence of recorded prices, costs or labour figures for construction in the Roman world scholars have sought other documentary sources. To-date a considerable amount of research on the construction of ancient buildings has made use of nineteenth-century building manuals, in particular Giovanni Pegoretti's *Manuale practico per l'estimazione dei lavori architettonici, stradali, idraulici e di fortificazione, per uso degli ingegneri ed architetti* (1863; 1864). While the last decade has seen archaeologists and architectural historians use this manual to estimate the labour involved in Roman construction during the Roman period, demolition has remained unexplored, despite the fact that such manuals often provide significant data on demolition practices.

The purpose of this paper is to examine the extent to which this kind of post-antique documentary evidence can enhance our understanding of demolition and re-use. In particular, it will examine the ways in which nineteenth-century labour figures for the demolition of brick walls can aid in the understanding of the economics of demolition and re-use within Roman construction. The first part of this paper will address the methodological approach to calculating demolition in man-power, while the second part presents the labour figures for the demolition of brick walls provided by various nineteenth-century handbooks. The final part discusses how these figures and formulae from these manuals can be applied to Roman buildings. This will look specifically at the recovery of reusable materials, calculating the costs of equipment and manpower, and the economic implications of reusing second-hand material instead of newly produced ones.

Methodological Approach

For the Roman period, detailed building accounts for specific projects, which have been used in studies of the economics and logistics of construction in the Greek period, do not survive (on the Epidauros accounts, see Burford 1969). Indeed, outside Roman Egypt very few costs for building labour and materials survive from this period. The one notable exception is the Diocletian's Price Edict of A.D. 301, which offers an indication of the general cost of labour per day for a range of trades in the building industry as well as prices for some building materials (Johnson 1936: 306–10, 363–4, 472, 477; Graser 1940; Erim and Reynolds 1970; 1973; Lauffer 1971; Reynolds 1971; Giacchero 1974; Reynolds and Crawford 1977; 1979; Ermatinger 1990). How reliable or representative the figures in the Edict are, however, is difficult to gauge. The Edict announces itself as an attempt to enforce price-restraint and to halt price-specultaion by profiteers, rather than a list of current market prices (Lauffer 1971: 95; Duncan-Jones 1982: 367; Corcoran 2000: 205–233; 2006; Allen 2009; Rathbone 2009). As Duncan-Jones (1982: 364, 367) has pointed out, the Edict's total disregard of regional variation suggests that it cannot have been based on an appraisal of how prices stood in different parts of the empire. If the figures are reliable in any way, they are probably closest to the conditions of the Eastern Empire, where the Edict was both created and found. Despite this, as DeLaine has remarked, when it comes to estimating ancient building costs, the prices in the Edict 'are the best we have' (2001: 234).

The difficulties surrounding cost analyses of demolition are even more problematic than those for ancient construction. There are no accounts in the Edict or any other known ancient source for the maximum pay of a labourer cleaning bricks or sorting through rubble, and there is no known price list for re-used timber and brick. Analysis of the economics and logistics of demolition presents additional problems, since little is known about the price difference between old and new materials and thus the advantages or disadvantages of salvaging supplies from earlier structures. The supposition that reusing materials brought a significant economic advantage seems logical, but no precise assessment has been made to either prove or disprove this theory for the Roman period. In the absence of any ancient figures for the cost of using recycled materials, the only possible approach is that of calculating the intrinsic cost of the work required to acquire them. Such an approach has already been successfully demonstrated for construction by DeLaine (1997) and, more recently, by Barresi (2002; 2003) and Caré (2005). These studies employ a process based on the modern principles of quantity surveying,

the methodology of which is most completely set out by DeLaine in her work on the Baths of Caracalla (1997).

This method assumes that the cost of any type of construction is determined by the amount and type of labour expended in producing, transporting and putting the necessary building materials into place. The basic cost of construction therefore, as DeLaine made clear, is 'the cost of human action' (1997: 207). The major obstacle for the Roman period is the lack of work rates for specific building tasks, since those figures that do exist refer almost exclusively to agricultural tasks (White 1965: 102–107; Duncan-Jones 1982: 327–33). In overcoming this problem DeLaine, Barresi and Caré, all utilized data from Pegoretti's handbook (1863; 1864), which provided constants of labour for a variety of building tasks. While such a methodological approach has its problems, such as the disparity between ancient and historical construction techniques and the difference in working conditions between these two periods, basic man-power estimates can still be made (DeLaine 1997: 103–107; 2001: 232–233).

It is my argument that a similar methodology can be used to calculate the cost of recycled materials by determining the man-hours necessary for the demolition of various elements in Roman construction. The task, then, is to look at a specific form of Roman construction and reduce it to its component parts in order to determine the specific number and types of actions required to deconstruct each individual element. Then we must establish what material can be salvaged, what must be done to make this material reusable and what volume of material will end up as rubbish. The cost of transport must then be added to this figure in order to calculate the total cost of recycled material.

As with the studies of DeLaine and Barresi, the figures in this paper have been calculated using mainly Pegoretti's architectural handbook, but they have also been supplemented with data from the slightly earlier work by the engineer Ponza di San Martino (1841). The handbooks of both Pegoretti and Ponza provide useful sources for appraising demolition in Rome due to numerous similarities between the materials and construction techniques used in nineteenth-century Italy and those from ancient Rome, but where necessary these rates have been checked and supplemented by comparable handbooks (Morisot 1820–24; Hurst 1865; Rea 1902).

Nineteenth-Century Building Manuals and Labour for Demolition

Shirley (2000: 101) has argued that the figures given for demolition in nineteenth-century manuals refer only to the specific act of demolition and do not take re-use into consideration, thus making them unsuitable for assessing ancient practices. However, for Pegoretti (1863; 1864), Ponza (1841) and Morisot (1820–24) this is demonstrably not the case. Pegoretti (1863: 495–6; 1864: 164) frequently made references to the amount of possible reusable material throughout his analysis of demolition, offering for example, an estimate for the rate and volume of salvageable bricks. Morisot also specifies 'démolition pour pouvoir réemployer les matériaux' (1820–24: 285). Likewise, Ponza (1841), in addition to giving rates for basic demolition, also gave rates for what he called 'accurata' demolition where the intent was to re-use the materials. The following sections provide a discussion of the figures provided in each handbook, followed by the demolition figures for brick walls and a comparison of this data.

Pegoretti and Demolition

Pegoretti discusses demolition in two sections of his building manual. In the first volume he provides general information on demolition and a breakdown of the amount of recoverable material for brick and rubble walls (Pegoretti 1863: 495–496). In his second volume, he gives labour figures for the demolition of these wall types (1864: 159–187). Pegoretti distinguished between walls laid with and without mortar and then divided the demolition process into four main phases: dismantling, removal of material, cleaning and separating the reusable material, and disposal of the unusable material. In addition, he provided figures for the demolition of specific parts of structures, such as floors and roofs, based on the weight of the individual timbers and the height that beams needed to be lowered from. Pegoretti also provided figures for removing small and large roof-tiles, where once again the rate is calculated by area. Each of the various tasks listed above was divided into skilled and unskilled labour or a combination of both, given in man-hours per either cubic or square metres, depending upon the type of wall. The labour constants for the demolition of brick walls are shown below in Table 1 (Pegoretti 1864: 164).

Table 1: Pegoretti's rates for the demolition of brick walls, expressed in man-hours.

Task	**Labour**		**Volume**	**Stage of demolition**					
	Skilled	**Unskilled**		**Dismantling**	**Removal of material**	**Add per floor (1 floor =3–4m)**	**Separate, clean, and deposit**	**Separation of concrete**	**Salvage rate**
Brick wall bonded with mortar	1	1	$1m^3$	1.5	1.25	0.33	1.6	0.4	4/5
For the 'spicconatura' or demolishing with a pick, of an old brick wall	1	1	$1m^2$	0.6 – 0.8	0.6 – 0.8	n/a	n/a	n/a	n/a

Ponza and Demolition

Pegoretti drew heavily upon the earlier handbook by the engineer Ponza di San Martino, as a recent comparison of their datasets has shown (Barker and Russell, *forthcoming*). Like Pegoretti, Ponza (1841: 49) was interested in times, measured in multiples of ten-hour working

days. Additionally, Ponza provided costs, calculated in relation to the daily wages of different types of workers (Table 2). Ponza, however, was far more consistent than Pegoretti in specifying which type of worker was responsible for each task: common workers such as demolition masons (*muratore*) and labourers (*manovale*), as well as specialists, such as carpenters (*falegname*) were listed. Ponza also detailed extra costs that were separate from daily wages, including expenses for tools as well as providing cover, workshop space and storage for materials. For normal labourers these additional costs would have been minimal. Ponza (1841: 49) estimates about 4%, for example, for masons, but other manuals provide figures of between 10–20% depending on the task and speciality of the worker (Morisot 1820–24: 26–34; Rondelet 1867: 78; Ricci 1895: 132).

Table 2: Ponza's daily wages of different types of worker.

Worker:	**Daily wage (*Lire*)**	**Extras**
Muratore, mason:	2,20	-
Manovale, labourer:	1,00	+ 3.8%

In addition, Ponza (1841: 60–61) provided figures for demolition not given by Pegoretti, such as dismantling scaffolding, the demolition of walls made from cut stone and the removal of marble flooring. Again the sections are split between the two volumes, with general information on the demolition of buildings as well as figures for several types of walls, including cut stone (*muro in pietra di taglio*), rubble (*muro di pietrame*) and brick (*muro laterizio*) (Ponza 1841: 55–56). These figures are given in man-days for one mason and one labourer, and include the total time for dismantling, separating and cleaning, transportion and removal of debris.

Ponza noted that where materials are not being re-used demolition must be quick and inexpensive, but where materials are to be saved the method should be that which causes the least possible damage to the material (1841: 114). Ponza therefore provided two sets of demolition figures. Firstly, for what he called common demolition (*comune*), carried out with clubs, poles, hammers and iron-bars, and secondly, for what he called accurate or careful demolition (*accurate*) using hand tools such as chisels and hammers, with particular attention to preserving as much material as possible for re-use. The labour constants for the demolition of brick walls are shown below in Table 3 (Ponza 1841, 55–61).

Table 3: Ponza's rates for the demolition of brick walls, expressed in man-hours.

Task	**Labour**		**Volume**	**'Common' demolition**		**'Accurate' demolition**	
	Skilled	**Unskilled**		**Skilled**	**Unskilled**	**Skilled**	**Unskilled**
Brick wall in mortar	1	1	1m³	3.0	1.5	4.5	3.5

Morisot and Demolition

The second edition of Morisot's work (1820–24) is probably the largest architectural handbook ever produced. Like Pegoretti and Ponza, Morisot provided a general text on demolition as well as a number of figures for the demolition of different types of walling. Morisot, like Ponza, gave figures for dismantling walls of cut stone that are missing from Pegoretti. He also provided specific figures for the demolition of walls with the use of animal-power and for the removal of demolished materials on sledges, rollers and in carts. Morisot's figures for the dismantling of brick walls included a rate per 1,000 bricks rather than per cubic metre of wall. These figures are listed below in Table 4 (1820–24: 285–287).

Table 4: Morisot's figures for the demolition of brick walls, expressed in man-hours.

Task	Labour		Volume or number	Demolition	
	Skilled	Unskilled		Per skilled	Per unskilled
Demolition of brick wall for re-use of material	1	1	1m³	3.23	3.23
Demolition of brick wall and cleaning bricks for re-use	1	1	1m³	9.44	9.44
Demolition of brick wall and cleaning bricks for re-use	1	1	Per 1000 bricks	13.30	13.30
Removal of debris to a distance of 10 *toises* (1 = 1.949 m or 6.394 ft)	1	1	1m³	0.48	0.48

British Manuals and Demolition

Two British architectural manuals also give labour figures for demolition. Hurst's (1865: 379, 381, 384) handbook provided several figures for demolishing rubble walls, brick walls and marble flooring. Unlike Pegoretti, however, Hurst did not divide his demolition figures into stages. Instead, he gave an overall total for demolition, in man-hours, for both rubble and brick walls. Hurst did specify, though, that his figures were for taking down, cleaning and stacking only. For rubble walls, his figures are per cubic yard and for brick they are per rod (8.7 m^3). The major difference between the figures from Pegoretti and Hurst is the division of labour. Pegoretti recommended one skilled and one unskilled labourer for the dismantling process, and one unskilled labourer for the subsequent tasks of removal, separating and cleaning and disposal of unusable material. In comparison, Hurst required just one unskilled labourer for all of his processes.

The second manual, Rea's handbook (1902), is similar to that of Hurst, but the figures, like Pegoretti's, were divided into dismantling, removing, cleaning and stacking. Like Hurst, Rea's figures were given in man-hours per cubic yard for rubble and per rod for brick. For brick walls

though, Rea gave two figures: one for walls bonded with lime mortar and another for walls bonded with cement. This distinction is particularly useful when attempting to correlate ancient and pre-Industrial labour constraints, as ancient Roman concrete was more similar to cement than to lime mortar. One problem with Rea, however, is that his removal figures specified the use of a wheelbarrow which, as far as we know, was not used in ancient Rome. Once again details of the labour constants for brick walls are shown below in Table 5 (Hurst 1865: 379; Rea 1902: 178).

Table 5: Hurst's and Rea's rates for the demolition of brick walls, expressed in man-hours.

Task	**Labour**		**Volume**	**Dismantling, cleaning and stacking**	
	Skilled	**Unskilled**		**Hurst**	**Rea**
Brick wall in lime mortar	1	0	1 m^3	4.6	5.7
Brick wall in cement	1	0	1 m^3	n/a	6.9

Comparing Demolition Figures for Brick walls

Comparisons of the figures for demolition in these architectural manuals reveal remarkable similarities (Table 6). By converting all of the figures for brick walls into man-hours per cubic metre we find a difference of around 3% between Hurst's and Pegoretti's figures and 20% between Pegoretti's and Rea's figures for a brick wall bonded with lime mortar. Morisot's figure for demolishing brick walls is the only anomaly: just under twice that of Pegoretti's figure. With the exception of Morisot, the figures are all of the same order of magnitude for equivalent actions. In fact, detailed analysis of the comparability and accuracy of these manuals in respect to stone-working figures suggests that the manuals themselves are reliable data (Barker and Russell, *forthcoming*).

Table 6: Comparison of demolition rates for brick walls, expressed in man-hours.

Task	**Volume**	**Pegoretti 1863–1864**		**Ponza 1841**		**Morisot 1820–1824**		**Hurst 1865**		**Rea 1902**	
		Skilled	**Unskilled**	**Skilled**	**Unskilled**	**Skilled**	**Unskilled**	**Skilled**	**Unskilled**	**Skilled**	**Unskilled**
Demolition of brick walls in mortar	m^3	4.75	4.75	4.5	3.5	9.44	9.44	4.61	-	5.77	-

It is important to stress that the rates in this article are not for pure demolition, but rather for careful deconstruction. The differences between Ponza's common and accurate forms of demolition suggest that careful deconstruction would have taken about 55% longer than common demolition. Similarly the difference between Pegoretti's demolition of brick walls for re-use is just over 30% higher than for demolition with a pick (*spicconatura*). Although deconstruction is more time-consuming, as is demonstrated below, the economic potential for re-use out-weighs the increased man-hours. The next task is to see how these figures can aid in our understanding of Roman demolition and re-use.

Applying the Figures

As the above sections have demonstrated, the five nineteenth-century building manuals discussed provide broadly similar equations for brick demolition rates. However, since Pegoretti is the best-known and most often used of these handbooks, the following calculations will be based primarily on his figures in order to maintain continuity between this and studies on the labour requirements of construction. The process of deconstruction for brick walls would have involved four basic steps: the actual dismantling, the removal of material a short distance from the demolition site, the cleaning and sorting of the reusable bricks, and finally the removal of demolition rubbish.

These steps are also attested in historical building accounts. The building accounts for Ashley House in Surrey (built 1602–1605) show several payments, under the heading 'work done by the day', to workmen and labourers for demolishing an old house at Ashley. The payments were recorded for the tasks of demolishing, removing material, cleaning bricks and tiles for re-use in the new house, and clearing the site of demolition rubbish (Blackman 1977: 60–63). Similar payments for demolition, cleaning and removal of material were also recorded in connection with the demolition of old St. Peter's in Rome (Orbaan 1919). These accounts reinforce the idea that demolition was a process involving a series of tasks that required the use of a number of different labourers, both skilled and unskilled. As Ponza stated, 'it is preferable not just to use labourers, but instead to employ specialist workers as this will result in a higher preservation of reusable materials' (1841: 15, translation by the author).

The major difference between the labour rates of pre-Industrial and Roman building techniques lies in the properties of the materials used. A Roman brick is obviously different from a nineteenth-century one, and likewise Roman concrete differed in strength from nineteenth-century mortar. In order to adjust for ancient conditions, several modifications need to be made to the nineteenth-century rates. These modifications, like those in DeLaine's study (2001: 234–235), were based not on translating figures from Pegoretti directly into ancient activities, but rather by looking at individual factors in a piecemeal fashion.

Let us examine Pegoretti's figures for brick walls. For my calculations, the rate at which a labourer could remove a brick is taken here as standard. This is supported by the fact that despite difference in brick size between Italian and British bricks (Barker, *forthcoming*), there is only a minor difference between Pegoretti's, Hurst's and Rea's rates for dismantling brick walls. The dismantling rates, however, do suggest that the strength of mortar greatly impacted the rate of demolition. This can be seen in Pegoretti's rate for bricks bonded in lime mortar and Rea's rate for brick bonded with cement. In order to use Pegoretti's rates for disassembling brickwork then, the rate had to be adjusted to reflect the differences in the amount of mortar used in each period and the strength of the mortar. This was done by calculating the rate per

brick and then adjusting for ancient conditions to attain a rate per brick for demolition of an ancient Roman brick wall. The rate for removing the demolished material from the site for a Roman brick wall was taken as that given by Pegoretti, since it is the volume of material and not the ratio of brick to mortar that is important (the weight difference between ancient bricks and mortar and nineteenth-century Italian bricks and mortar per volume a man can carry is negligible). As for cleaning and separating the bricks, once again the quantity and strength of the mortar was important, but so was the fact that there would have been less surface area to be cleaned for Roman bricks in a cubic metre of wall than there would have been for nineteenth-century bricks (roughly 53% that of a standard nineteenth-century brick: Barker, *forthcoming*). The decreased surface area of brick in contact with mortar was only partially counteracted by the increased amount and hardness of Roman mortar. The difference in surface area in contact with mortar was 1:2 for a Roman brick compared to Pegoretti's nineteenth-century brick (Barker, *forthcoming*). Consequently, even though the rate of cleaning was increased by 20% to account for the increased strength of the mortar, the rate of cleaning per Roman brick was still markedly less than Pegoretti's rate. This was supported by discussions with masons specializing in the restoration of historic British buildings. Therefore, as the strength of mortar offset the difference in cleaning rates due to the decreased surface area in contact with the mortar, a cleaning rate per brick was calculated from that given by Pegoretti. These figures give us a rate of 1,470 bricks that could have been dismantled, cleaned, separated and removed from a site per man-day. Alternatively, 1m² of brick facing would have taken 0.05 man-days for the same processes. For the recovery rate of salvageable bricks the figure provided by Pegoretti (1864: 164) was used: 4 out of every 5 bricks, however this may have been higher if the bricks were to be used in a wall's core.

Now lets look at a hypothetical wall 12 m by 3 m by 0.59 m, based on the brick-faced concrete walls from the *Case dei Dipinti* at Ostia, which held an average of 72 bricks per square metre (DeLaine 2001: 254–255). This section of wall would contain 5,180 bricks. To dismantle the brick facing using figures adjusted from Pegoretti's formulae it would take 1 skilled and 1 unskilled labourer about 1.24 man-days, with a further 1.57 man-days for 1 unskilled labourer to remove the material from the demolition site and 0.73 man-days to separate, clean and deposit the bricks, a total of 1.24 skilled man-days and 3.5 unskilled man-days (excluding the demolition of the wall's core). Taking Pegoretti's salvage rate gives a total of 4,144 bricks which could be obtained through demolition: roughly 57.6 m² of a new brick-facing or a wall 80 % the length of the original.

In comparison, the production of bricks during the Roman period involved a variety of processes: digging clay, weathering and tempering the clay to remove any impurities, moulding the clay into shape, and drying it prior to its firing in a kiln (DeLaine 1997: 114–118). This whole process required time; the drying process alone could take between 4 and 5 weeks (DeLaine 1997: 115). Furthermore, production was seasonal: 'clay was dug in late summer, autumn, or winter, and left to weather until spring', and then produced between April to September (DeLaine 1997: 114). In addition to time, the production of bricks also required a reasonable investment in man-power. The production for 1,000 *bessales*, for example, would have taken a total of 3.01 skilled and 1.71 unskilled man-days (DeLaine 1997: 118, Table 9).

Using these production figures we can compare this data with our demolition figures. It would take a total of 2,072 *bessales* to produce the equivalent 4,144 salvaged bricks. Using the production cost of new *bessales* as outlined above means that it would have required roughly 6.24 skilled and 3.54 unskilled man-days, excluding transport costs. This gives a saving of 51% for salvaged brick compared to newly produced ones. When we consider the savings in

cost and the amount of material potentially generated from these re-used bricks (roughly 57.6 m² of a new brick-facing), it seems obvious that builders, imperial or private, would have made use of this potential.

Conclusion

This paper has demonstrated the potential in using nineteenth-century labour figures for understanding demolition and re-use during the Roman period. By using this resource some of the unanswered questions regarding recycling have been addressed, including how costly, in terms of man-days, demolition was; what the likely recovery rate of reusable brick was; and what the economic implications of reusing second-hand instead of freshly produced material was. In focusing on these questions this article has been able to demonstrate the potential level of saving that could have been attained through the practice of careful demolition and re-use. This analysis suggests based on Pegoretti's labour figures that Roman builders could have saved up to 51% for brick. Although these figures do not include any of the additional expenses for tools or accommodation mentioned above, it is likely these would not have affected the overall savings greatly. In reality the savings could have been even higher since the production costs estimated above exclude the cost of cutting the *bessales* into bricks and the transportation of the bricks to site, which would have increased the overall costs, and impacted greatly upon the decision to re-use salvaged bricks. Such economic benefits make it more than probable that systems of salvage were exploited by Roman builders. Indeed, given such economic potential it becomes apparent why recycling was such a success, particularly in urban centres such as Rome and Ostia, where continuous rebuilding could ensure a steady supply of second-hand bricks. Additionally, second-hand bricks had the added advantage that builders could use them immediately onsite or within the city without the waiting-time or transport costs involved in producing new bricks. Through an analysis of re-use and demolition, this article has shown the potential that nineteenth-century handbooks can provide in discussions of the Roman construction and demolition industries.

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